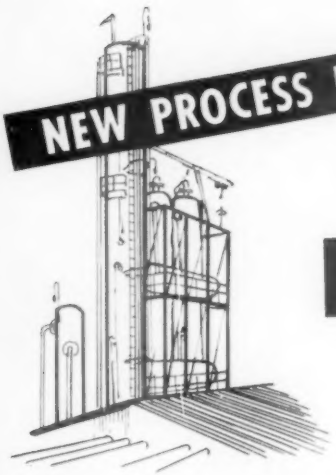
the OIL AND GAS JOURNAL

JANUARY 7, 1957



NEW PROCESS FOR

Upgrading Light Gasolines

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Gulf still persevering on

World's Orneriest Wildcat Well

p. 80

Three Strikes Give Rockies a Lift

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Petrochemical Pipelines May Bring Plants to Midwest p. 106

A RESOLUTION THAT TURNED INTO A HABIT

The old saying, "New Years' Resolutions are only made to be broken", has never been accepted here at Halliburton. It never had a chance! First, because in all the years since Halliburton cemented its first well, we have held steadfastly to but one resolve...one purpose: to aid the recovery and production of oil...with optimum results at minimum costs...with maximum possible protection to untapped reserves...by providing intelligent, effective, integrated services to this end. That Halliburton remains dedicated exclusively to its primary purpose is proof enough that one good resolution...faithfully kept...stands the test of time...and competition. Second, because every year adds stature and strength to a firmly rooted...healthy...still growing *desire* to serve. Good resolutions...firmly guarded and kept...eventually become good habits. And *sincere* service is a habit we intend to keep...and continue to cultivate...to the benefit of every Halliburton customer and the Industry we are proud to serve.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

"PROGRESS IN SERVICE THROUGH RESEARCH"

A Glance Ahead

- Closer spacing of pipeline pump stations is being studied as a means of getting around the steel shortage. Closer spacing would permit lower-pressure operations, and this in turn would make possible the use of thin-wall pipe. Some companies do not consider the practice feasible. But others are taking a serious look because of the long-range prospect for a tight steel supply.

- More JP-5 jet fuel with a low freezing point will be bought this year by the Navy. Consumption of this grade is expected to increase by some 4,000 bbl. daily.

  The JP-5 fuel, with a flash point of 140°, is safer for storage on aircraft carriers. The freezing point will be lowered from —40° to —50° to permit its being carried in the uninsulated wings of planes.

- The pure chemical companies are continuing to look to petroleum and natural gas fractions for their future feed stocks. Add another such company which is considering the organic chemical field and is looking Southwest for its most likely plant site.

- Dresser Industries has developed a bit which it hopes will stand up under the stresses of high-speed turbodrilling. Both the bit and the turbodrill itself soon will undergo testing in the field. One test already has been arranged at a location in West Texas, another has been set up for Mississippi.

- Floating barges for Gulf Coast drilling may be in prospect. California operators, who first developed the method, say there has been a substantial increase lately in queries from Gulf Coast operators. The reason: As gulf operators go farther from shore, they get in deeper water. And as water depth increases, the less expensive and more mobile floating barges look more attractive.

- Government spending will increase sharply in the last half of this year. It will give new impetus to a boom that is showing signs of getting tired. The federal budget may jump as much as $2.5 billion over the present level. State and local budgets may jump as much as $3.5 billion.

- The Navy's claimed right to drill for oil on any land under its control will be one of the first issues taken up in the new Congress.

  A House committee will go into the matter in the next 2 weeks or so, as a big item in its probe of military land "grabs," particularly in the outer Continental Shelf.

the OIL AND GAS JOURNAL

JANUARY 7, 1957 • VOLUME 55 • NUMBER 1

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY–OPERATION

Drilling-Production

How 16 Wells Were Drilled Directionally **99**
By A. G. G. de Chastelain
Inaccessible locations have necessitated considerable directional drilling in Canada. Directional surveys and knowing how formation dip will affect hole deflection are important.

Continental Finds 762-Volt Power Cheaper **109**
By C. A. Bingham
In two pools in western Kansas 762-volt electric power systems for pumping wells have been 12.5 and 14 per cent cheaper than 440-volt systems.

Slim Holes Successful in Tristate Area **114**
By Arnold F. Lewis

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By T. Murray Robinson
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By Dr. John M. Campbell

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By Norman S. Morrisey
The best bargain in the oil business is a foot of hole drilled by a contractor. Footage prices have been steadily dropping during the last 10 years. A Journal survey.

The Fox-Bush Water-Flood Project **126**
By J. P. Powell
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By D. S. Brereton and J. Dunki-Jacobs
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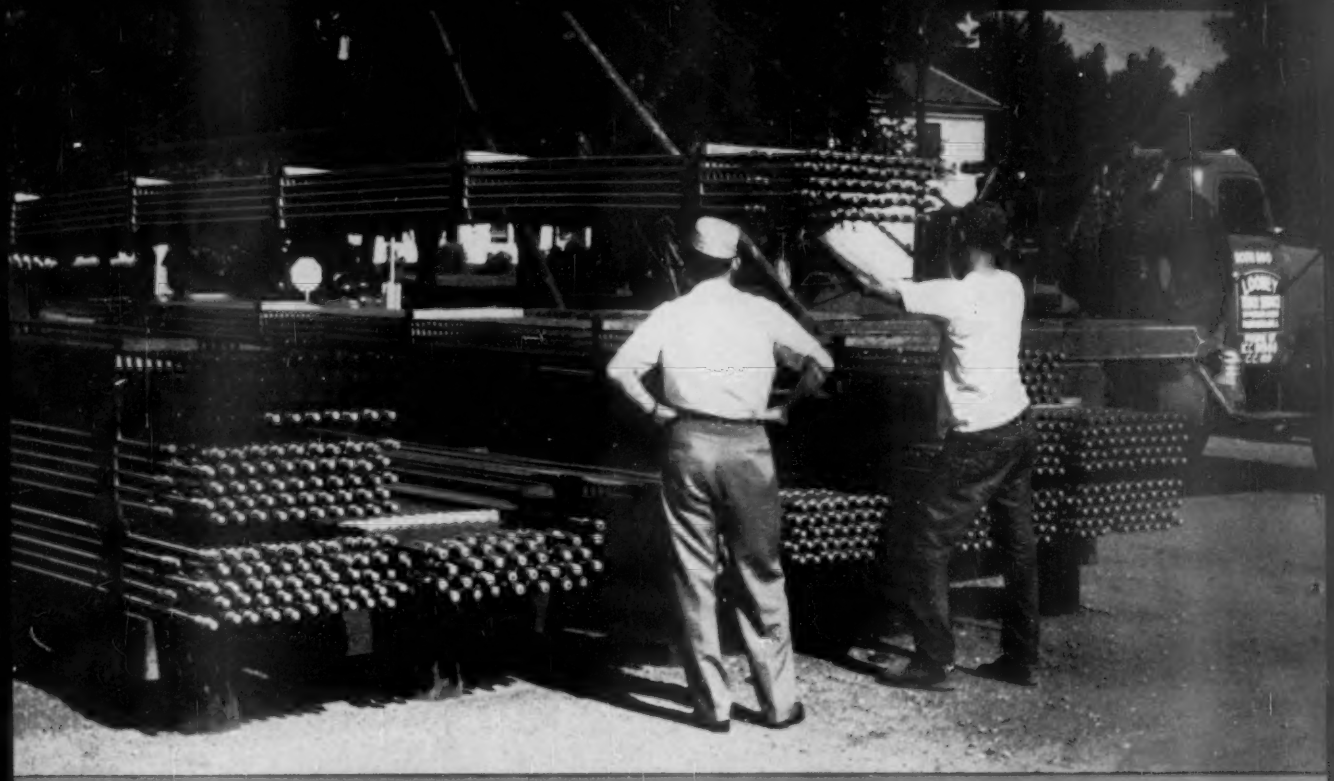

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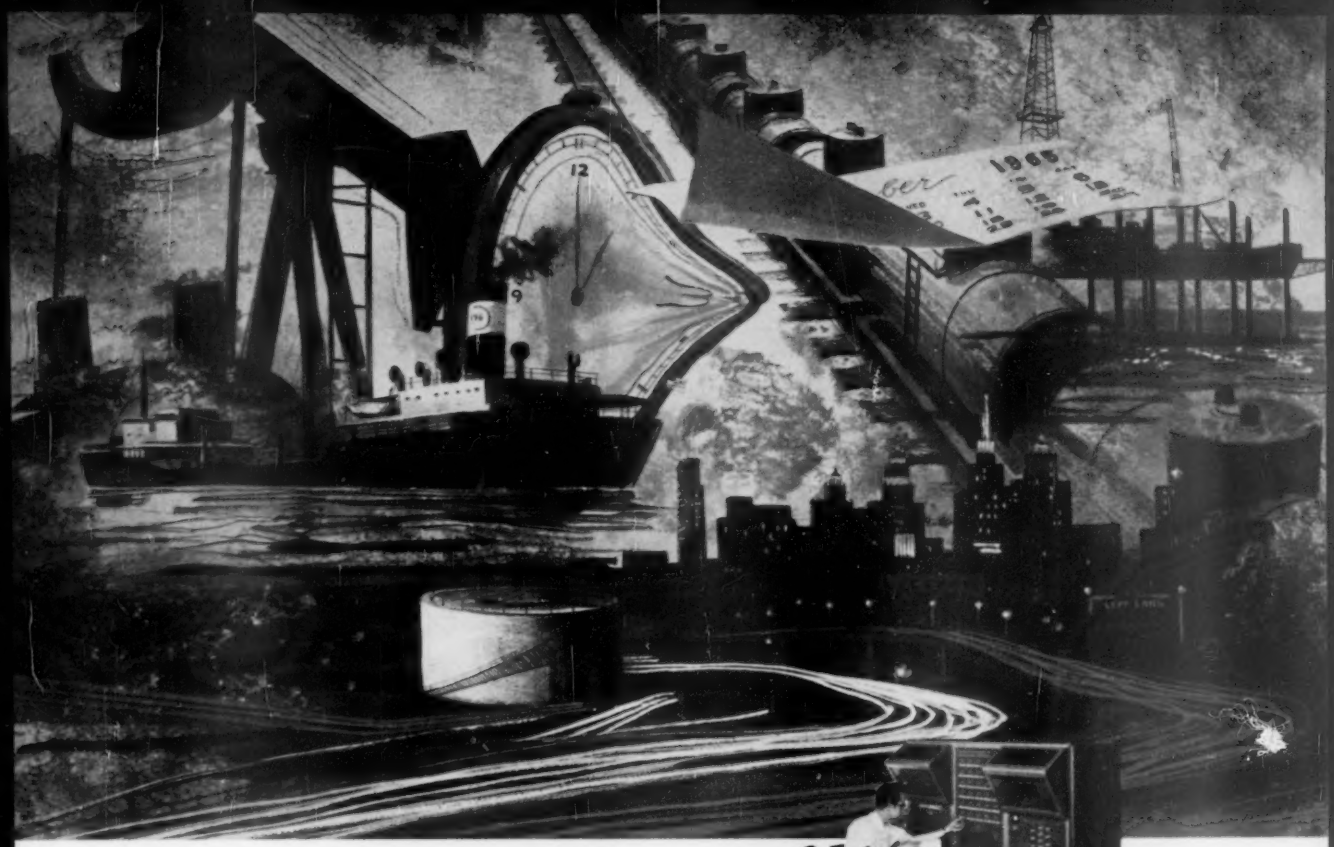

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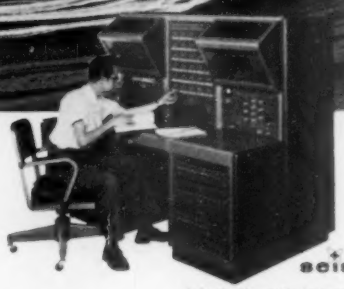

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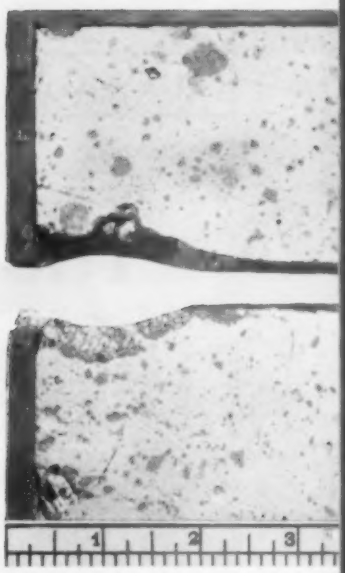

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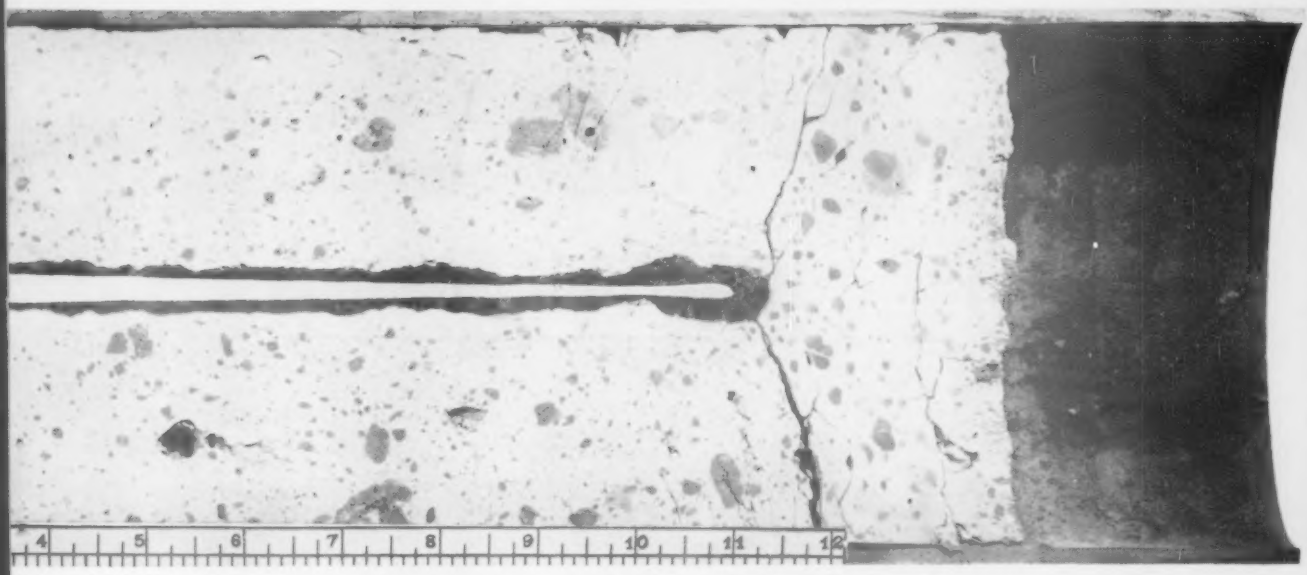

Welex Dyna-Jet fired in water through N80 steel casing into 16-day neat cement target produces a .58" entrance hole with 11.28" total penetration and 38.4 cc. hole volume.

NEW CONCEPT OF PERFORATING

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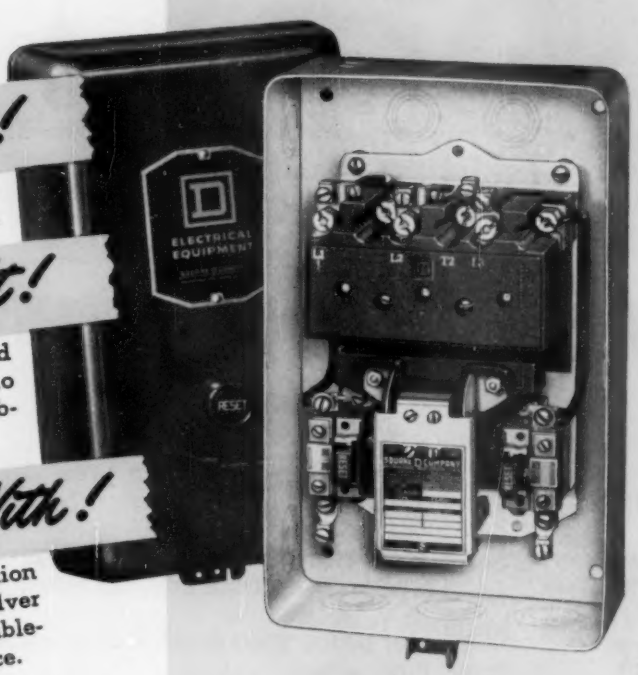

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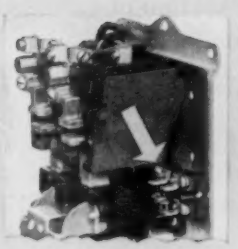

ELECTRICAL INTERLOCKS are available in kit form. Practically any necessary number or arrangement of extra interlock contacts can be added to any standard starter. Sizes 2 and 3 starters have new front-of-panel mounting interlocks for faster, easier installation. *(See cutaway at left)*

***Write** for Bulletin 8536*

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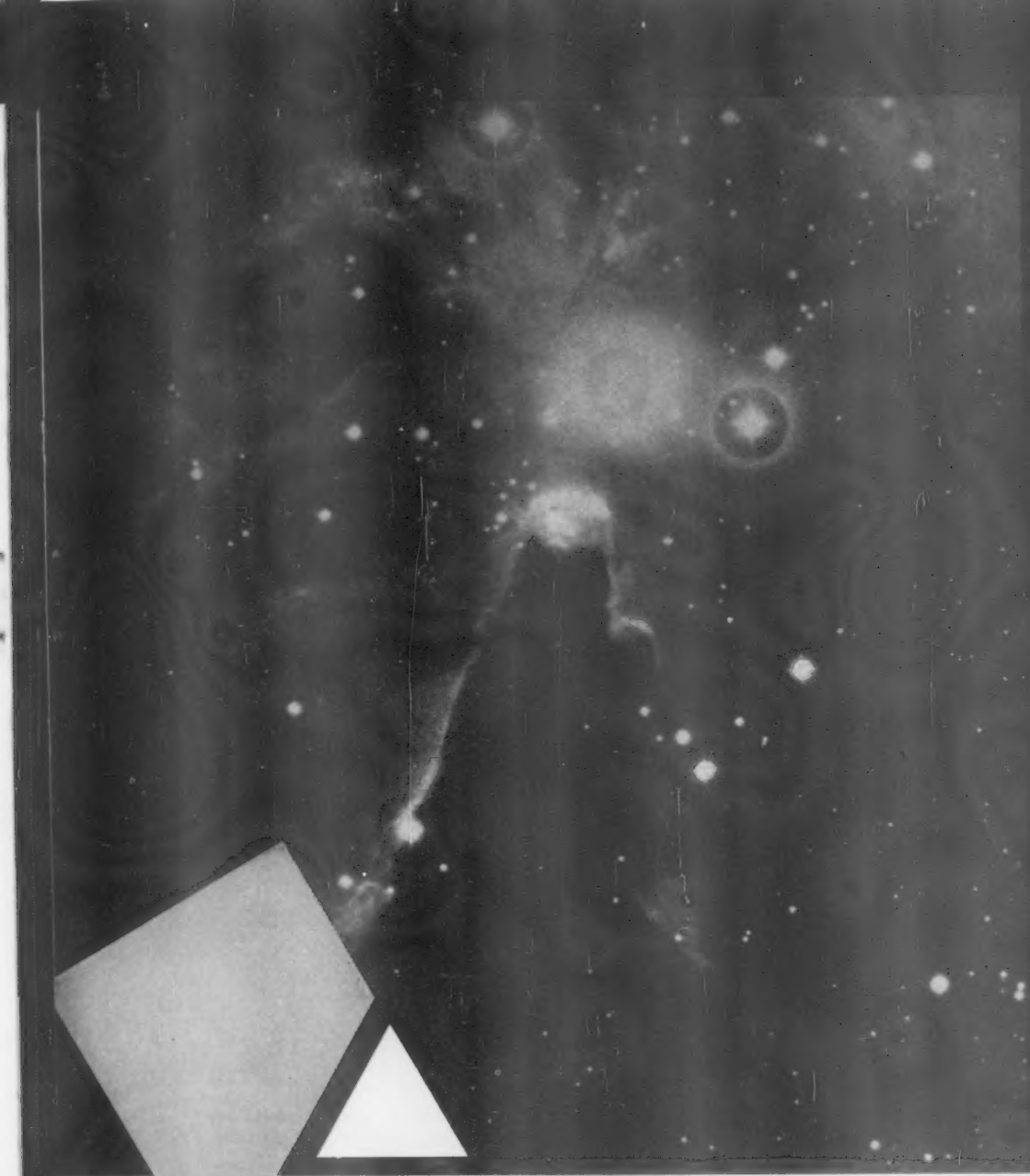


The "Cone Nebula" in the constellation of Monocerus photographed through the 200-inch Hale telescope of the Palomar Observatory. This mass of stars is about 1,000 light-years, or roughly six million billion miles from the earth.

MEASURING THE UNSEEN

Although attempting nothing so spectacular as measuring unseen stars through a 200-inch telescope, Tuboscope research is paying off for oil men everywhere. From Tuboscope research have come new instruments for measuring the nearly unseen effects of wear, fatigue, and corrosion in oilfield tubular goods. And from Tuboscope experience in the field comes the ability to inspect and to grade your tubular goods with the greatest possible precision and with the least chance for human error. The important factors of bottom hole pressure and temperature are measured by Tuboscope's Subsurface Engineering Division.

2919 HOLMES RD. • HOUSTON, TEXAS

Tuboscope COMPANY

THESE '57 CHEVIES TURNED THE TOUGH ALCAN HIGHWAY INTO A TURNPIKE!

They took the "teeth" out of North America's toughest truck run in an amazing display of stamina and dependability! The Chevrolet Alcan test called for great truck components . . . and here they are, the same modern features you'll get in *your* '57 Chevy!

Modern high-compression 6's—a time-proved Chevrolet truck 6 made the tortuous Alcan Highway test look easy . . . registered a high 18.17 miles per gallon!

Short-stroke V8 power—with the shortest stroke of any truck V8's, new Chevy engines stand first in their field for efficient load-pulling! Their great performance in Alaska proved it!

Safe, sure brakes now Alcan proved—in medium-duty models, Hydrovac power brakes* supply up to 85% of the braking effort! Powerful Air-Hydraulic brakes* gave peak stopping power in heavy-duty models!

Unit-design cab and body construction—Chevrolet truck cabs and bodies remained tight and solid on Alcan bumps, showed that they're built to *last!*

Rugged Synchro-Mesh manual transmissions—they displayed never-say-die durability . . . came through with smooth, flexible, trouble-free performance!

*Revolutionary Powermatic transmission**—Drivers of heavy-duty models reported shift-free driving ease on Yukon grades, safer downhill hauling with the hydraulic retarder!

Sturdy frames and long-leaf springs—these brawny chassis components proved they can take it when the going is roughest . . . took the Alcan's worst with strength to spare!

These Alcan-proved Task-Force 57 features and others like them (such as extra-heavy rear axles, mighty Triple-Torque tandem options, and new, improved tubeless tires) are ready to tame your tough truck runs too! Boost your hauling profits by seeing your Chevrolet dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

1957 CHEVROLET TASK-FORCE TRUCKS

PROVED ON THE ALCAN HIGHWAY . . . CHAMPS OF EVERY WEIGHT CLASS! CHEVROLET

THE MODERN VIEWPOINT ON SCRAPER TRAPS

SELF-SEALING GASKET — made of Hycar (oil and gas resistant rubber) — is the final answer to scraper trap leaks. Its lipped design makes it self-sealing under line pressure. The coupling cannot be over-tightened to the extent of damaging the gasket or the coupling itself.

UNIBOLT

No threads to gall or freeze . . . No leaky seals . . . No doubt about strength — it conforms to all codes . . . No multi-bolt flanges.

Release two bolts. Swing the trap open. Take the pig out or put the pig in. Close the trap and tighten two bolts. That's just how simple and easy it is to operate a UNIBOLT Scraper Trap. An over-size barrel (slightly larger than the o. d. of the pig) makes it equally easy to start a pig. Line pressure does the heavy work.

Pipeliners everywhere are using UNIBOLT closures and couplings for scraper traps, blowdowns, strainers, mist removers and other large diameter pressure vessels.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

Pump keeps working, oil keeps coming with TIMKEN® bearings on the crankshaft

THIS Worthington VTE-2 Plunger Pump has to inject water under pressure into oil-bearing sands to revitalize the well and keep oil coming. It's a 24-hour-a-day job, day-in, day-out. The pump mustn't stop for any reason. To keep it on the go with unattended operation, Worthington engineers mounted the crankshaft on Timken® tapered roller bearings, got maximum efficiency, prevented costly well shutdowns.

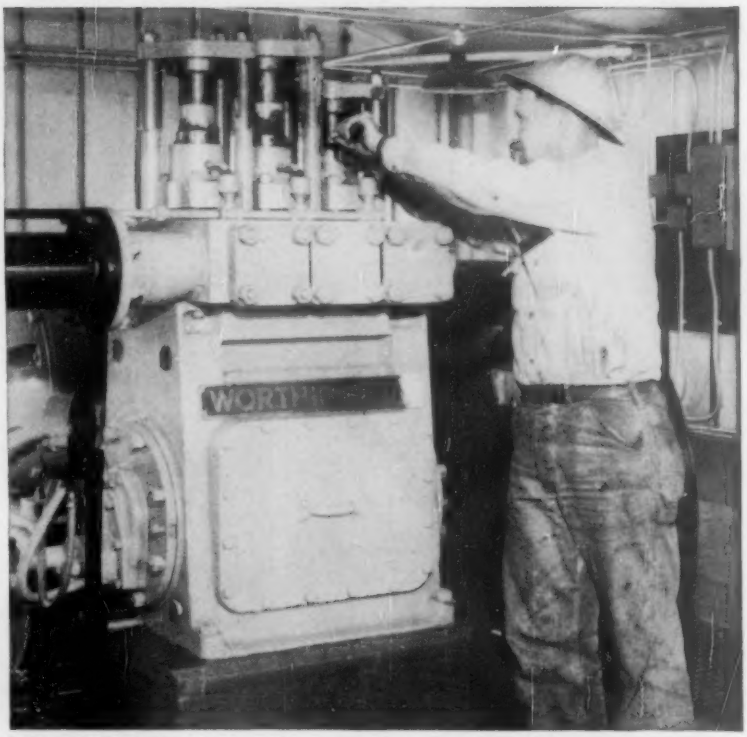
Because of their tapered construction, Timken bearings take both radial and thrust loads in any combination. The crankshaft is held in positive alignment. Wear on crankshaft and adjacent parts is sharply cut. The pump keeps working steadily, dependably. And because Timken bearings keep housings and shafts concentric, closures are more effective. Dirt's kept out, lubricant in, maintenance is reduced to a minimum.

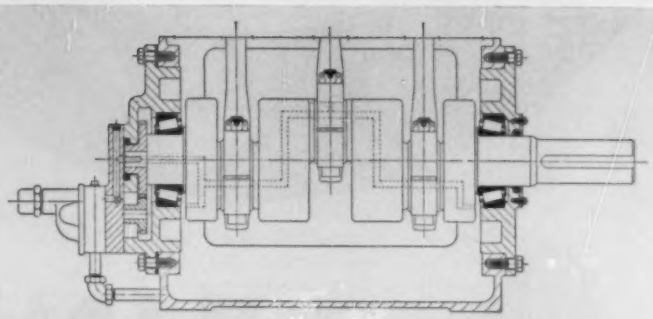
What's more, Timken bearings save power. They practically eliminate friction. Timken bearings are geometrically designed to have true rolling motion, and precision-manufactured to live up to their design. The pump operates smoothly and economically on Timken bearings.

We even make our own fine alloy bearing steel, to be sure it's the finest. We're America's only bearing manufacturer that does.

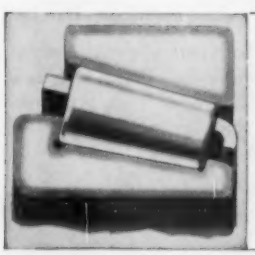
Only Timken bearings give you all these advantages. To get them, always specify Timken bearings on the oil field equipment, or *any* machine, you buy or build. Always look for the trade-mark "Timken" on every bearing. It's your sign of value. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product ...eans its bearings are the best.





HOW WORTHINGTON CORPORATION mounts the crankshaft of its VTE-2 Plunger Pump on Timken bearings to assure dependable performance, reduce wear and maintenance.



HARD ON THE OUTSIDE, TOUGH ON THE INSIDE

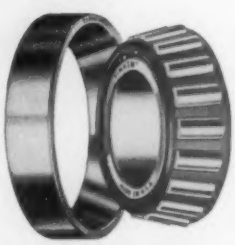
Rollers and races of Timken bearings are case-carburized to give a hard, wear-resisting surface over a tough, shock-resisting core. Result: longer bearing life.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. Timken fine alloy steels.

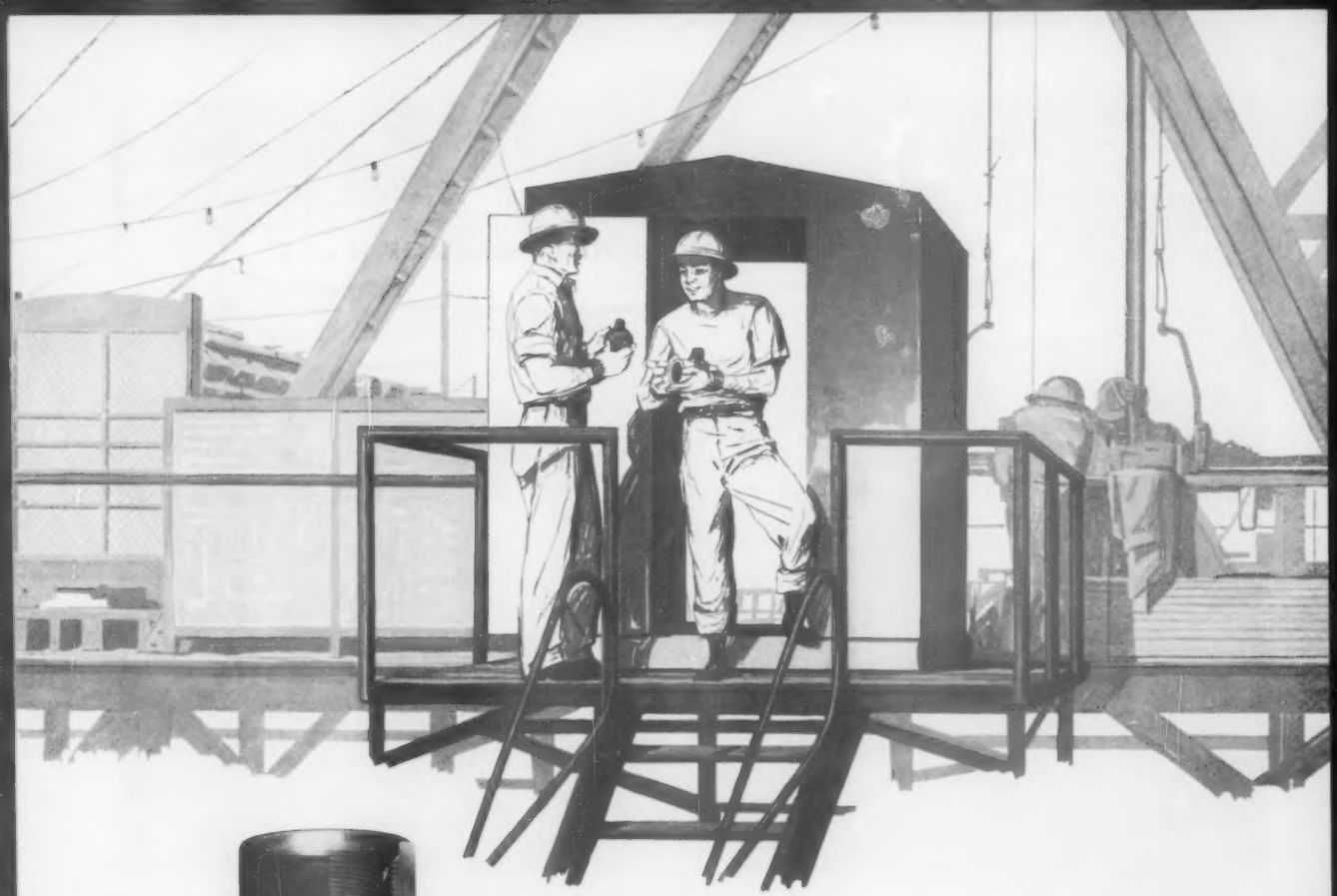
TIMKEN

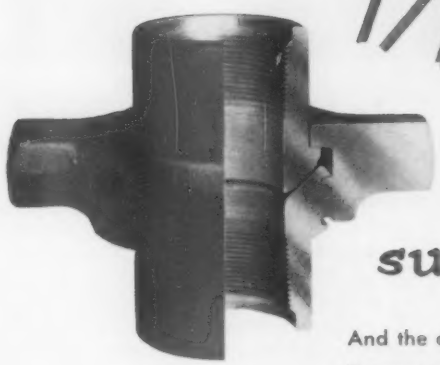
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ▯ AND THRUST ⊣▯⊢ LOADS OR ANY COMBINATION ✳





"I didn't realize there was such a difference in unions!"

And the difference is quite obvious when you compare Weco with other unions.

To start with—Weco's exclusive ball and cone seat design gives you the most perfect sealing possible. The spherical surface of the male sub seats on the conical surface of the female sub forming a positive, leak-proof seal. The sturdier construction of Weco Unions takes the most punishing service as part of a regular day's work. The Acme threads permit faster, easier make-up and break-out, day after day, without damage or distortion.

These differences in the design and construction of Weco Unions pay dividends in longer life and superior sealing service.

Ask for Weco Unions at supply stores everywhere. They are available in the exact size and pressure required for all oil country connections.

U-8-56

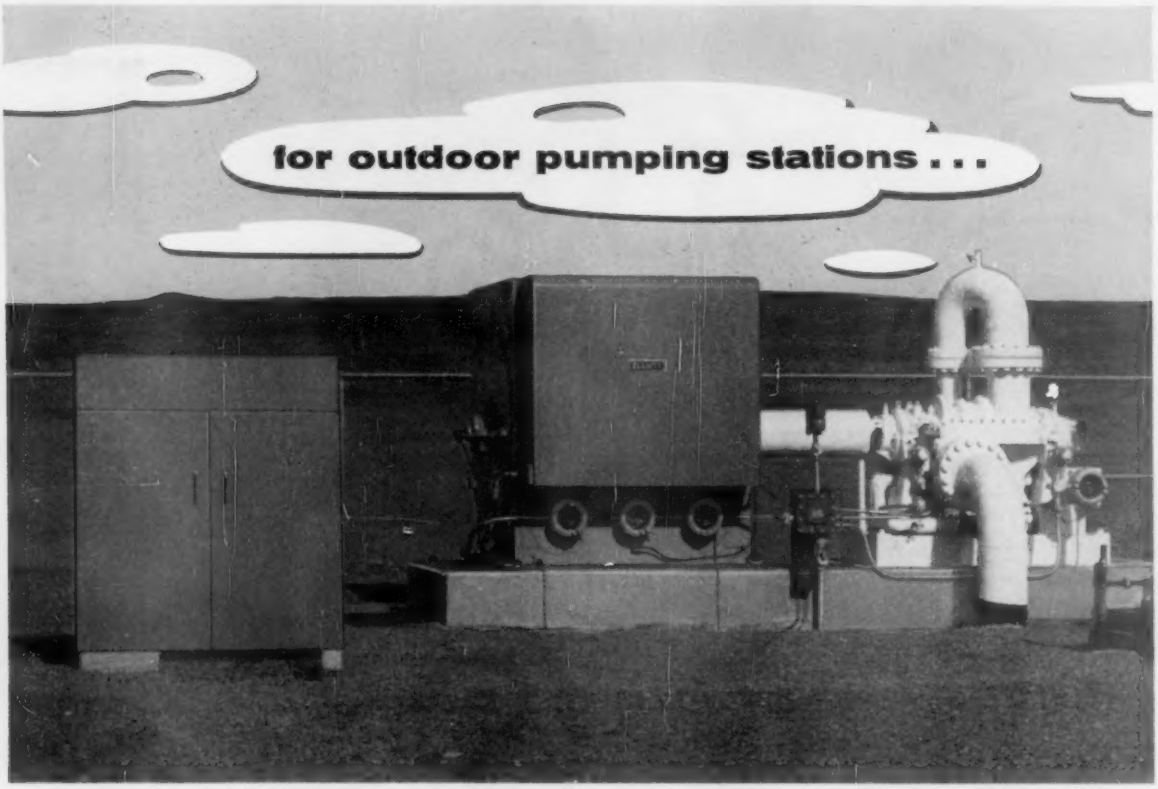
WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

PESA

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION



no enclosures or special foundations needed with **ELLIOTT PIPE LINE MOTORS**

Through the use of Elliott Weather-Protected Motors, pumping stations are greatly *simplified* without sacrificing *dependability*. In the station shown above, an Elliott 1500 hp 2-pole 3600 rpm squirrel cage induction motor is direct connected to a two-stage oil pump. This motor is specially designed for pipe line service, and is so completely weather-protected that no special house or enclosure is required.

The motor bearings are flood-lubricated by a self-contained system which includes a geared pump, oil filters, and an air-to-oil cooling system within the motor housing. Temperature detectors protect both bearings and motor windings. Space heaters inside the motor enclosure are energized when the motor shuts down, thus preventing condensation of moisture. Relays and controls are protected by glass-covered explosion-proof enclosures.

Based upon their satisfactory experience with weather-protected motors, this company has standardized on the simplified outdoor pumping stations rather than the more costly enclosed stations.

For further details, write Elliott Company, Ridgway, Pennsylvania, or consult your nearest Elliott District Office.

R6-22

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

DU PONT *Petroleum Chemicals* NEWS

One of a Series of Bulletins for the Petroleum Industry

JANUARY 1957

New Du Pont presentation will inform public on oil industry

DU PONT VICE-PRESIDENT

JOHN F. DALEY, a director of the American Petroleum Institute and a member of the Institute's General Committee, Division of Refining, was recently appointed a vice-president of the Du Pont Company.

Mr. Daley joined the Du Pont Company in 1915 as a timekeeper in the explosives plant at Carney's Point.

When made a vice-president he also became a member of the executive committee and director of Du Pont. Prior to holding these positions, Mr. Daley was general manager of the Organic Chemicals Department, which includes the Petroleum Chemicals Division.

In 1940, Mr. Daley's experience in explosives manufacture was made available to the government. During the war, he served as manager of the Indiana Ordnance Works and as deputy field director of ammunition plants, with jurisdiction over 55 government-owned plants. For this work, he was awarded a commendation for exceptional civilian service by the Secretary of War.

He returned to Du Pont as director of pigments sales in 1944, later becoming general manager of the Pigments Department. He was appointed general manager of the Organic Chemicals Department in 1948.

A clear, concise—yet highly dramatic—explanation of our American business system is packed in the small, lightweight briefcase pictured below. It's a presentation kit with a story woven closely around oil industry products and activities. Tentatively, it has been named "A 'Brief' Case for Business."

The theme of the story is that the *customer* actually makes the important business decisions today. It also points up very clearly the interdependence of big and little businesses in filling customer needs.

PETROLEUM PLAYS an important part in the production of all the items in this presentation kit. And the entire kit fits compactly into the lightweight easy-to-carry briefcase.

This public relations presentation—prepared by the Du Pont Petroleum Chemicals Division—shows how oil is truly the lifeblood of American industry. Yet its points are made in such a way that they are applicable to almost any segment of our economy. The audience appeal of this presentation is, therefore, exceedingly broad.

"Magic Barrel" idea

The new briefcase kit tells an oil industry public relations story in much the same way as the popular "Magic Barrel" has been doing so successfully for a number of years.

The briefcase is not meant to replace the "Magic Barrel," which will be continued. Rather it is to supplement that program. It can be presented to groups who have already seen the Barrel, or where the Barrel is for some reason not feasible or appropriate. The new presentation has been streamlined, including fewer items than the Barrel. These items, however, have been carefully selected to tell the story forcefully.

Low cost

Another advantage of the briefcase is its low cost . . . only $50 including all the products in it.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DUPONT *Petroleum Chemicals* NEWS

CONTINUED

New Presentation

Within the oil industry, there are now about 1200 speakers trained to give the "Magic Barrel" presentation. These men and women can, with practically no additional training, present the new program. And to acquaint them quickly with the new kit, we are supplying complete instructions as well as an easy-to-follow script.

THE NEW petrochemicals presentation is easy to learn, easy to give, yet high in dramatic quality . . .

H. C. THOMPSON, assistant promotion manager, demonstrates.

Now available

This new presentation is being sponsored by the Oil Industry Information Committee. To order these kits, or for further information about them, just get in touch with one of our representatives at the nearest Du Pont Petroleum Chemicals Division office listed below.

We will also be glad to train as presentation speakers—at no cost to refiners—any personnel who are not familiar with this type of public relations program.

DuPont Estersil GT solves problem of "leaking greases"

Crane and power shovel operators, among others, are reporting unusually satisfactory results from greases made with Du Pont Estersil GT (grease thickener).

One contracting company, for example, wanted a grease which would not leak on hoist drum brake bands, particularly at high ambient temperatures. A number of different greases were tried with no success in solving the problem.

The contractor's petroleum supplier then suggested an estersil-based grease. This type of grease will not break down even under severe high-temperature, high-shear working conditions.

The experiment was an outstanding success. The estersil grease was used on three different crane hoists. In all cases, the leakage problem was completely solved.

Conversely, estersil greases also have properties that are the answer to many extremely low-temperature lubricating problems. Since wide temperature changes produce little change in their consistency, there is little danger of estersil greases losing their lubricating value in sub-zero temperatures.

High water resistance

In addition to outstanding thermal stability, estersil greases have "built-in" water repellency and superior mechanical and oxidation stability. They also have superior handling qualities and can be easily manufactured.

Du Pont Estersil GT is now available in commercial quantities. Any of our representatives will be glad to give you samples and more complete information. Call the sales office nearest you.

Film dramatizes oil industry expansion

"It Never Rains Oil" is an animated color cartoon about a very serious subject.

It tells how percentage depletion helps to keep oil production ahead of the world's mushrooming demand. You have probably seen the film and of course know the value of percentage depletion.

However, the point of this suggestion is—shouldn't *more* and *still more* people be informed on this important subject?

Movie prints are still available for your use. In case you know of some other groups who should see it . . . new personnel employed over the past two years, for instance . . . write for the film.

Planned and produced by the Du Pont Petroleum Chemicals Division, the film is sponsored and distributed by the American Petroleum Institute, Independent Petroleum Association of America, Mid-Continent Oil and Gas Association, Rocky Mountain Oil and Gas Association and Western Oil and Gas Association.

Big and small businesses work together

The tremendous amount of business generated by "big business" for "small business" is pointed up in a new survey by the Du Pont Company. It shows that small firms represent 90% of Du Pont's 75,000 customers and 30,000 suppliers.

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

E. I. DU PONT DE NEMOURS & COMPANY (INC.) • PETROLEUM CHEMICALS DIVISION • WILMINGTON 98, DEL.

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ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

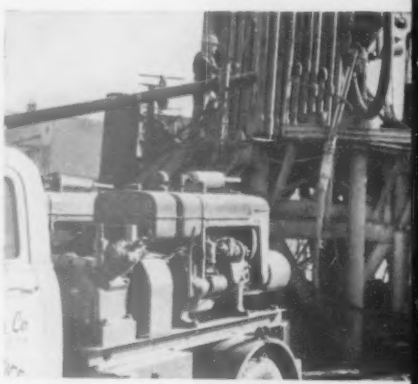
Serial No. A-3266

Printed in U.S.A.

How International® Engines . . . help find, pump, and deliver oil and gas at low cost!

DRILLING...

$2.20 PER 10-HOUR DAY! That's the butane fuel cost of the International U-450 power unit driving this Wilson truck-mounted winch. Unit is owned by Vick Well Servicing Company, Kilgore, Texas.



3800-FOOT WELL IN 7 DAYS AND 8 HOURS! Powering a compressor which operates air tongs in a casing setting job at Huntington Beach, Calif., two International U-2A carbureted engines helped set this record for D. F. Bloom Co.

PUMPING...

NO FUEL COST PER HOUR! By using natural gas from the well, this International U-164 carbureted engine pays for itself in a very short time. It is one of 50 International engines pumping in an area less than half a city block, near Athens, Texas.

SO GOOD, HE OWNS 120! Joe Vanardel, master mechanic for L. B. Johnson Drilling Co., Kiefer, Okla., says "120 of these International pumping engines have proven to have low maintenance cost, long life between overhauls, and are very easy to work on."

PIPELINING...

86 MILES OF 30-INCH PIPE IN 60 DAYS! International carbureted engine on cleaning and priming unit stays well ahead of job to help Houston Contracting Company stay ahead of schedule. Job is located near Eudora, Ark.

100% INTERNATIONAL POWER! Long, low-cost, dependable life are the reasons why Fred Linneman, Inc., Denver, Colo., uses nothing but International power on his pipeline spread. Parson's Trenchliner, here, uses an International UD-14A diesel engine, cuts 1,600 feet per day.

Whatever your oil and gas power needs, from 10 to 200 hp, your International Power Unit Distributor or dealer can fill them quickly and dependably. You have your choice, too, of power units burning the fuel that's most easily and economically available to you.

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Trucks . . . Diesel and Carbureted Engines . . . Motor Trucks.

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Company
180 North Michigan Avenue, Chicago 1, Illinois

an ACCO product

American Cable TRU-LAY VHS | 15% STRONGER

For Deeper, Safer, Faster Drilling... New VHS Rotary Drilling Lines

No matter where you go, you'll find that more and more rigs are equipped with rotary drilling lines of new TRU-LAY VHS. Made from a new grade of steel for wire rope, new VHS is at least 15% stronger than IPS—the strongest grade available before VHS.

Drill Faster—Less Down Time

The greater strength of new VHS allows you to drill deeper before increasing the number of parts of line. And VHS's extra strength eliminates, in many cases, any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factors.

Higher Safety Factor

The safety factor for 10 lines of VHS is about equal to the factor of safety for 12 lines of IPS. Or the factor of safety for 10 lines of VHS is 14.9 or 15% higher than for 10 lines of IPS.

Resists Abrasion, Peening

New TRU-LAY VHS is tougher, too. Because it is stronger and tougher it has greater resistance to abrasion and higher resistance to peening—both important factors in maintaining shape and diameter. Ton-mile advantages should result if regular adaptable cut-off practices are followed.

Winch-Lines, Too

Winch-Lines of new TRU-LAY VHS are now available with all the advantages this stronger, tougher rope can bring to this grueling application. For Rotary Drilling Lines and Winch Lines of new TRU-LAY VHS . . . just call your nearest Mid-Continent Supply Store. You don't need any complicated specifications—just tell them the size and diameter you want.

For further information write to the nearest American Chain & Cable Company office listed at right for
Brochure DH-516H.

ACCO

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AMERICAN CHAIN & CABLE

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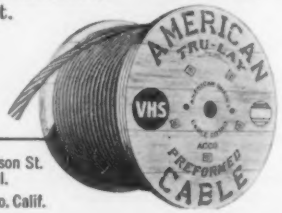


You Need The Model MDH

LOW TEMPERATURE
BS&B
SEPARATION

COLD-FRAC* SYSTEM

When Your Gas Condensate Wells...

1 Are Extremely High Pressured

MDH COLD-FRAC Systems will give condensate recoveries comparable with more elaborate low temperature separation systems when the pressure reduction across the choke is sufficient to produce a temperature drop of 80° F. or more. This is normally obtained with inlet pressures of 4,000 psi or more and with the low temperature separator operated at approximately 1,000 psi or less. Special heat exchanger achieves maximum cooling with minimum pressure drop through counterflow with cold sales gas.

2 Produce Wax and/or Salt Water

The highly efficient BS&B Model DC Liquid Knockout is an integral part of the MDH COLD-FRAC System. It effects maximum scrubbing efficiency by removing particles 10 microns in size and larger. This inlet knockout handles the maximum rated gas capacity without carryover while handling a normal volume of liquid. Waxy oils and salt water are efficiently removed and bypassed around the heat exchanger and choke, eliminating operating problems and refrigeration losses.

3 Have A Pressure Life of 3 to 5 Years

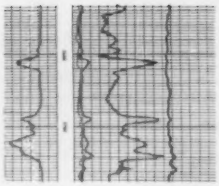
MDH COLD-FRAC Systems are especially suitable for wells with a pressure life of 3 to 5 years, which normally maintains the proper balance between initial cost and added recovery. If the pressure life of the well is less than 3 years, the BS&B ECON-O-MAX unit should be considered; if more than 5 years, the GDH COLD-FRAC (with hydrate inhibitor) will insure maximum recovery throughout the extended life of the well.

Ask Your BS&B Representative For Details, Or Write To...

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Div., Dept. 1-A1

P. O. Box 1714 Oklahoma City, Oklahoma



LOGGING'S CLOSEST APPROACH TO ZERO TRANSMISSION ERROR

When your well is logged, accuracy of data is the foundation for profitable knowledge of the formations under your lease.

Virtual freedom from major source of data transmission error is bestowed by Halliburton's exclusive FM log transmission system that obsoletes older multiple-voltage transmission methods!

It's done with this unmatched feature... Self-calibrating FM transmitter rides downhole in the Halliburton tool. Information is conveyed to surface through the medium of frequency modulation. Thus it can't be affected by amplitude variations that could be caused by line leakage.

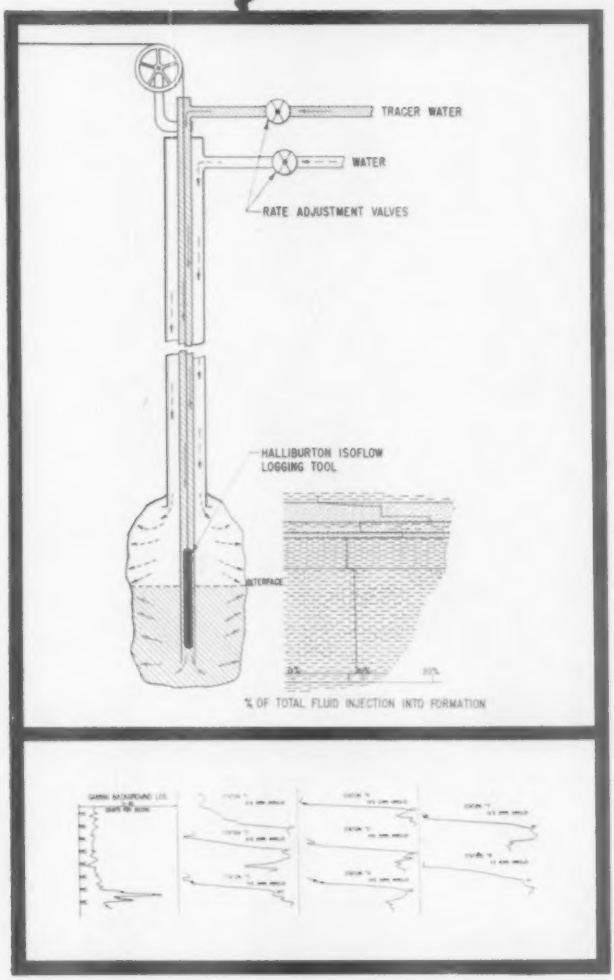
Logical outcome: For Electric, Contact, Radiation-Guard or other variable-quantity log records, well-wise oilmen specify Halliburton logging with minimum-error FM transmission.

HALLIBURTON

OIL WELL CEMENTING COMPANY DUNCAN, OKLAHOMA

"PROGRESS IN SERVICE THROUGH RESEARCH"

SHOWS FLOOD SWEEP TRENDS



HALLIBURTON'S ISOFLOW LOG

Here's a startling fact based on several years of records. *Nearly half* of all injection wells need workover jobs to give satisfactory flood sweeps! Otherwise much of the water injected is lost in ineffective zones.

To guide injection well workovers, Halliburton's Isoflow Logging offers a simple, reliable way of measuring injectivity profiles.

As shown in illustration, a short half-life radioactive tracer is dissolved in one of two streams of injection water. Flow is proportioned between tubing and annulus. An interface is thus established and located with a gamma ray counter. By varying the percentage of flow through tubing from 0 to 100%, a detailed foot by foot injection profile is obtained.

Your Halliburton Electrical Well Services field engineer can give you further helpful information on injectivity.

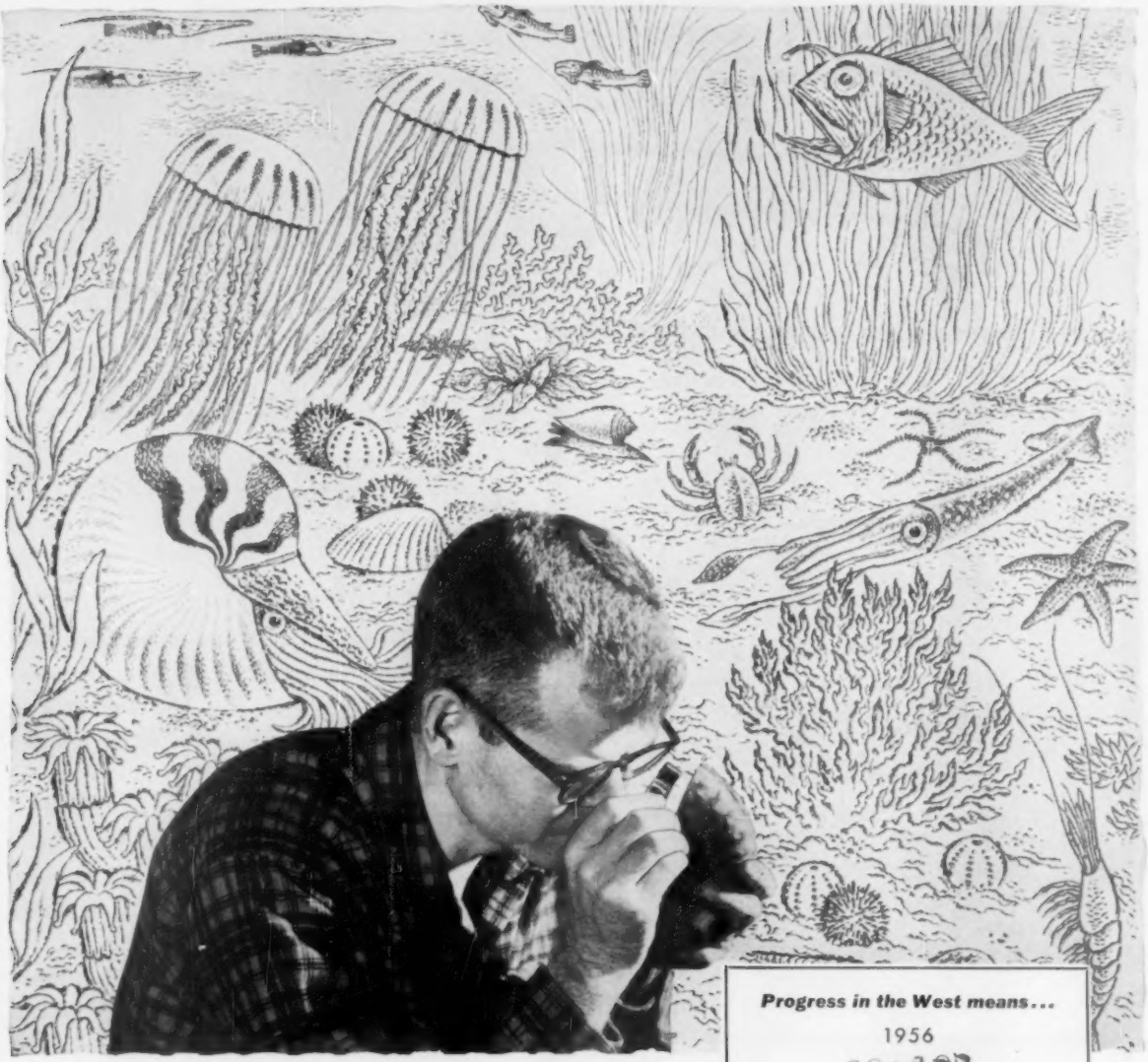
COMPLETE DATA SENT ON REQUEST

Ask for informative 16-page brochure, "Flow Logging"

HALLIBURTON

ELECTRICAL WELL SERVICES

Standard's educational program helps provide college training for 286 students this year



Industry needs many trained minds with specialized knowledge. For example, the paleontologist who supplies accurate data for oil exploration by studying fossils of marine life from millions of years ago.

THEY CALL THIS THE ATOMIC AGE . . . the era of the "thinking" machine. But above all, this is the age of *human* thought. For today our country needs more and more skilled minds to harness our atoms, advance our culture and guide our government. Standard, too, needs fresh concepts to maintain its position in a highly competitive business. That's why this year Standard's educational program makes available, through colleges, 234 scholarships for undergraduate study, 52 fellowships for graduate work, plus a series of grants to universities.

In these ways, Standard affords young people a better opportunity to contribute to their professions and communities.

Progress in the West means...

1956

trained people will be needed to fill 2½ million new jobs by 1965

1965

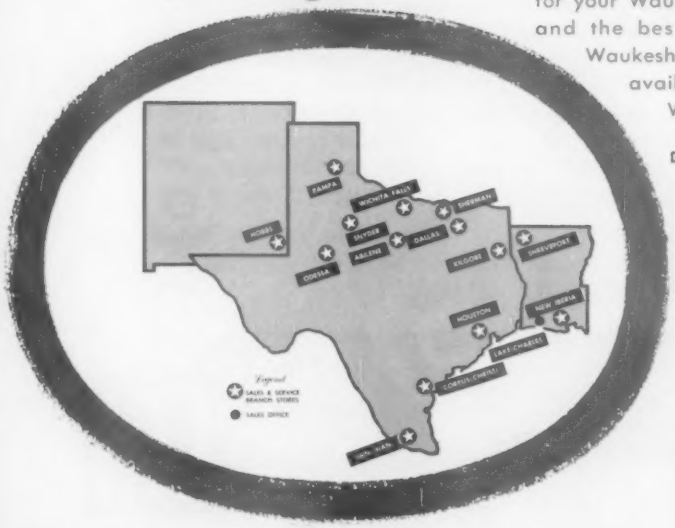
STANDARD OIL COMPANY OF CALIFORNIA

DON'T FEED ME THAT FAKE STUFF

I WANT ONLY *GENUINE* WAUKESHA PARTS!

When you buy a Waukesha engine you buy the finest power equipment money can buy. When you need parts for your Waukesha engine you naturally want the best—and the best parts, the parts made specifically for Waukesha engines, are **genuine** Waukesha parts, available throughout the oil country through Waukesha Sales and Service, Inc. stores.

Don't take a chance. Buy genuine Waukesha parts from the Waukesha Sales and Service, Inc. store near you.



WAUKESHA

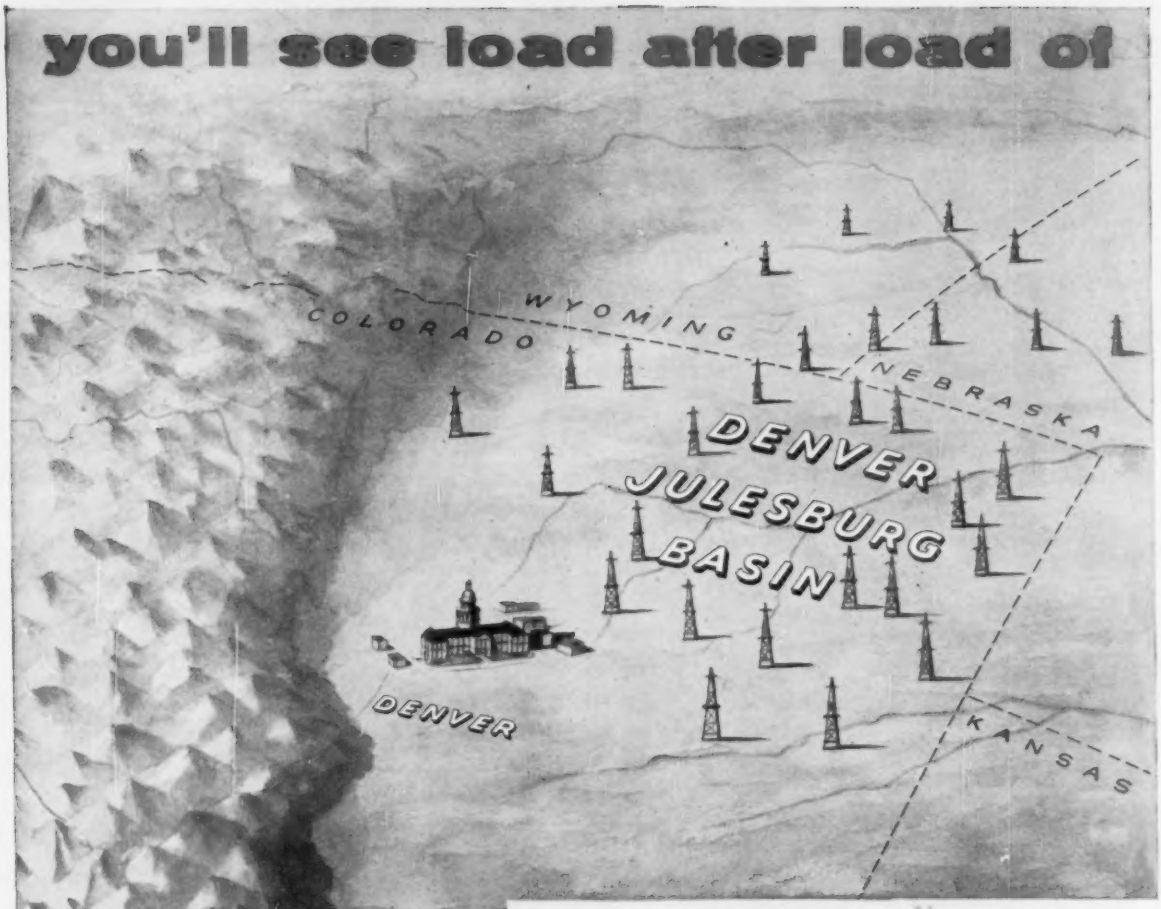
Sales & Service, Inc.

1422 MAURY ST. • HOUSTON, TEXAS

EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

you'll see load after load of



CF&I SEAMLESS CASING and TUBING

in the Denver-Julesburg Basin

There are good reasons for such acceptance. Every foot of CF&I Seamless Casing and Tubing is made under rigid quality controls to assure dependable service. And CF&I's mill at Pueblo, Colorado, is ideally located to give prompt, efficient service even on emergency rush orders. No wonder so many operators in the Denver-Julesburg Basin, and all over the West, depend upon CF&I Oil Country Goods!

Made to API STD 5A specifications, CF&I Seamless Casing and Tubing is available in popular sizes from 2⅜" through 9⅝" O.D.

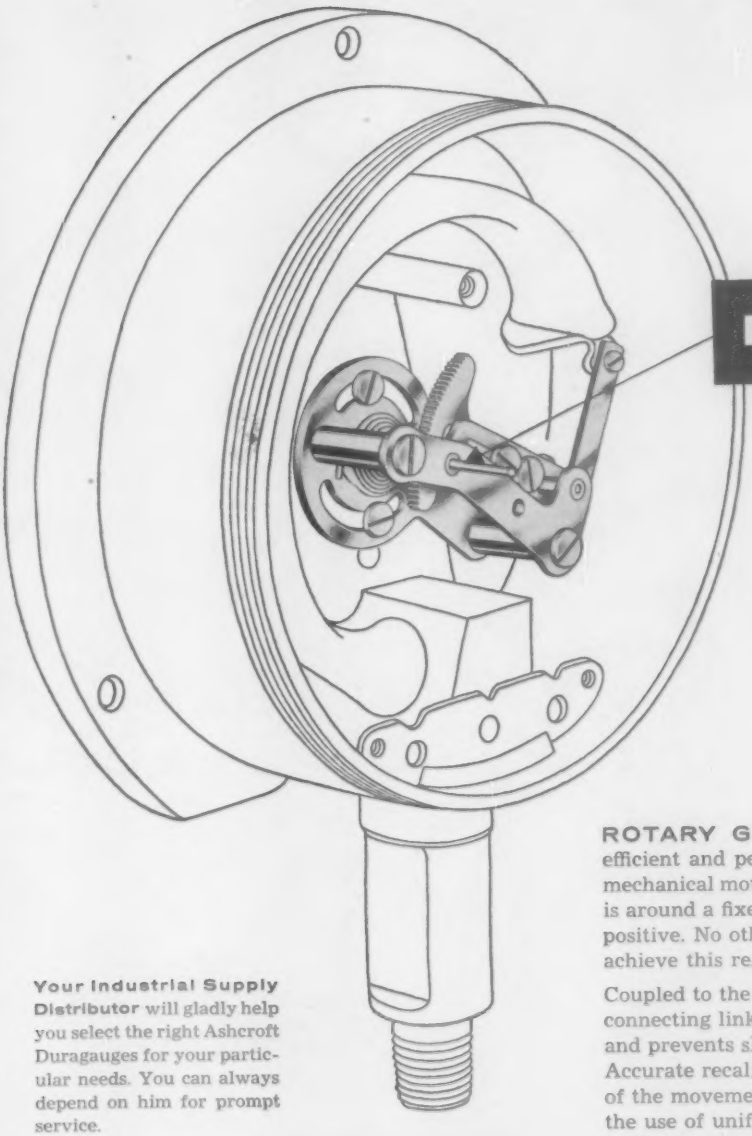
3693

SEAMLESS TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

Denver, Colorado

CF&I



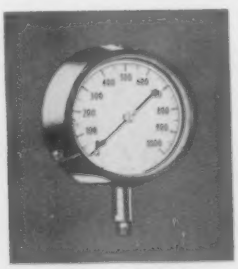
Why does the MOVEMENT in the ASHCROFT DURAGAUGE outperform all other types?

ROTARY GEARED MOTION, the most efficient and perfect method of transmitting mechanical motion ever developed. Because rotation is around a fixed center, pointer position is always positive. No other type of movement can ever achieve this result.

Coupled to the movement is a one-piece connecting link that guarantees correct calibration and prevents slippage or parting under tension. Accurate recalibration is easy from front or rear of the movement. Universal adjustability permits the use of uniformly graduated dials, thereby facilitating maintenance.

The Ashcroft Duragauge is available with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. There are case designs and materials, Bourdon tube materials, pressure ranges and dial sizes to meet your service conditions exactly. Save time, trouble and money. Specify the pressure gauges of highest sustained accuracy and durability – Ashcroft Duragauges.

Your Industrial Supply Distributor will gladly help you select the right Ashcroft Duragauges for your particular needs. You can always depend on him for prompt service.



In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

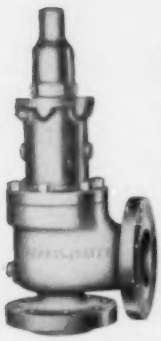
GIANT

TIDEWATER REFINERY

PROTECTED

by Consolidated Safety Relief Valves

FLYING A SERVICE



The world's most modern refinery will soon go on stream. It is the gigantic Delaware Flying A Refinery of the Tidewater Oil Company just 15 miles south of Wilmington. C. F. Braun & Co., engineering contractors, built the new plant on the 5000-acre site. Many of the processing units are unequalled for size and capacity anywhere. In around-the-clock operation, 130,000 barrels of crude of any kind can be processed daily. Tidewater engineers incorporated the most advanced design and equipment to provide the greatest flexibility, economy and safety.

Consolidated Safety Relief Valves are "sentinels of safety" in this mammoth "refinery of the future". Peak performance and consistently positive valve action are assured even where discharge lines are long or there is low "superimposed" back pressure in the relieving system. They provide the absolute protection so vital in petroleum processing and on product storage facilities.

Wherever Consolidated Safety Relief Valves are used, flexibility of application greatly reduces inventory costs. They are "2 in 1" valves. Interchangeability is so highly perfected that you can convert the Standard type to the Balanced Bellows Seal type *in the field* simply by installing a stainless steel sealing bellows. You can readily interchange these valves with those of other manufacturers: inlet and outlet center-to-face dimensions are standardized. Consolidated Safety Relief Valves also have fewer functional parts than comparable valves. The seating surface is optically-ground flat. From every standpoint, you can count on lower inventory costs and easy maintenance.

Write for full details about the complete reliability and all-around economy of Consolidated Safety Relief Valves. Both Standard and Bellows type are available in sizes and pressures to meet requirements today and tomorrow. Ask for Catalog 1900.

CONSOLIDATED SAFETY RELIEF VALVES

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

Tidewater Oil Company's "refinery of the future" has required nearly 7000 men in its construction. The enormous size of the installation can be gauged by the 500-foot high power station stack at the extreme left. To the right of the stack are, in order, the fluid coker, the sulphur recovery plant, the crude unit, the Orthoflow fluid catalytic cracker and other processing units. The Delaware Flying A Refinery's 7,000,000 barrel capacity "tank farm" is in the background. The refinery's processing units occupy 450 acres of the 5,000-acre site.

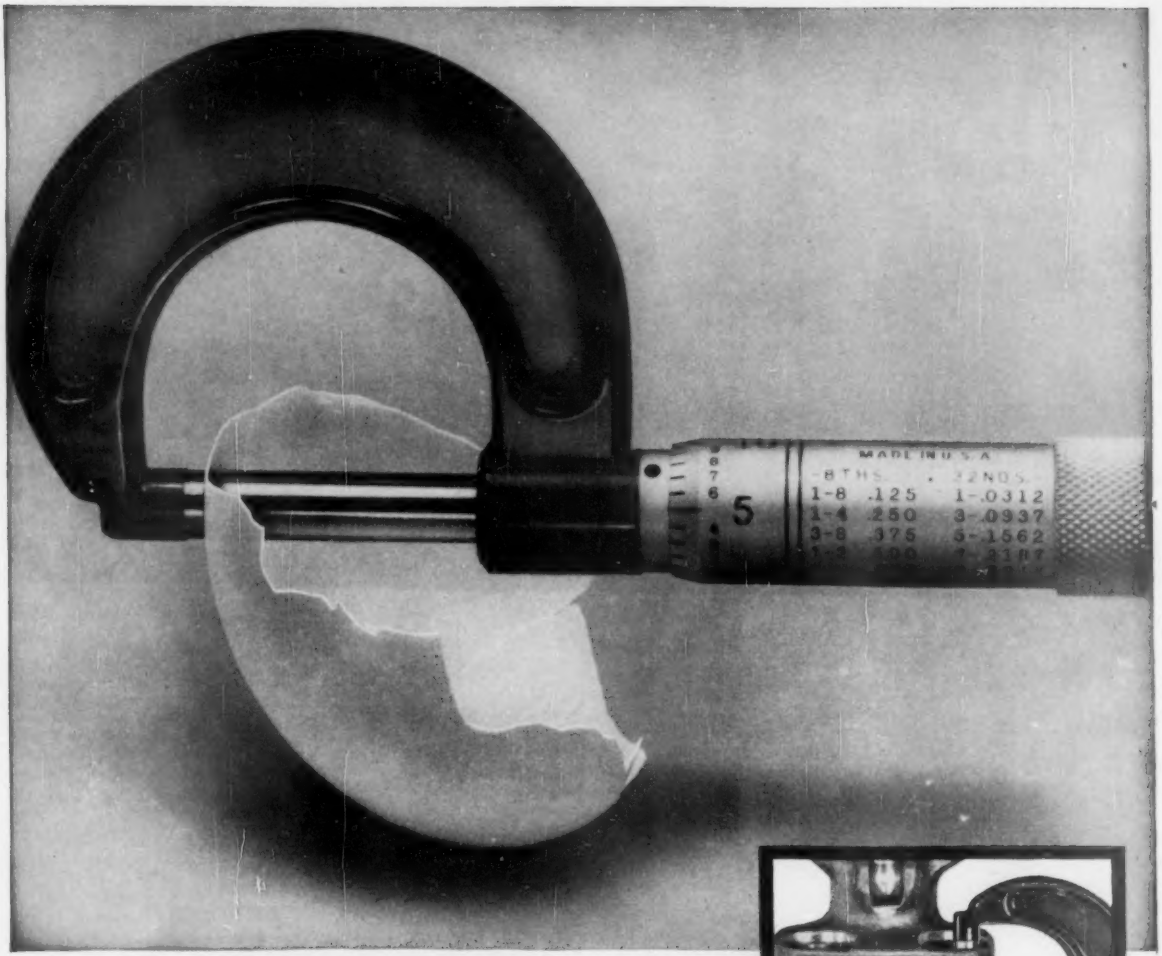
The Orthoflow catalytic cracker—the world's largest, with a daily capacity of 102,000 barrels—is equipped with Consolidated Safety Relief Valves.

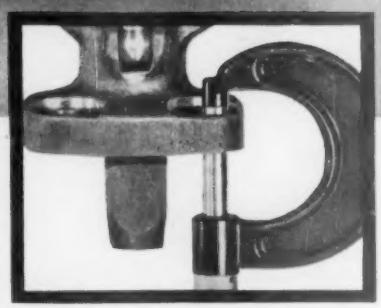
Consolidated Safety Relief Valves also stand guard atop the propane storage bullets at Tidewater's Delaware Flying A Refinery.

A PRODUCT OF MANNING, MAXWELL & MOORE, INC.

TULSA, OKLAHOMA

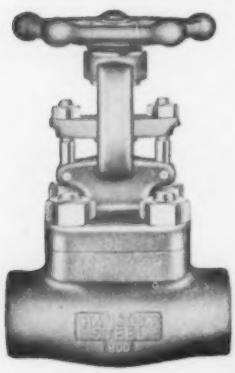
MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.*, 'HANCOCK' VALVES, *Watertown, Mass.*, 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.*, AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.*, "SHAW-BOX" AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.* **In Canada:** *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*





STRENGTH

that matches the purpose



THE BONNET FLANGES on the Type 950 Hancock Steel Gate Valve combine compactness with rugged strength *where strength is needed most.* Flange thickness and bolting provide sturdiness that can withstand more than ten times the rated pressure of the valve. Butting of the flange faces eliminates every possibility of bending and distortion.

In revalving old, or installing new process and power piping systems, the enduring strength of Type 950 Hancock Steel Gate Valves always proves there is no substitute for the economy of quality. Get complete facts. Phone your Industrial Supply Distributor today.

HANCOCK VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

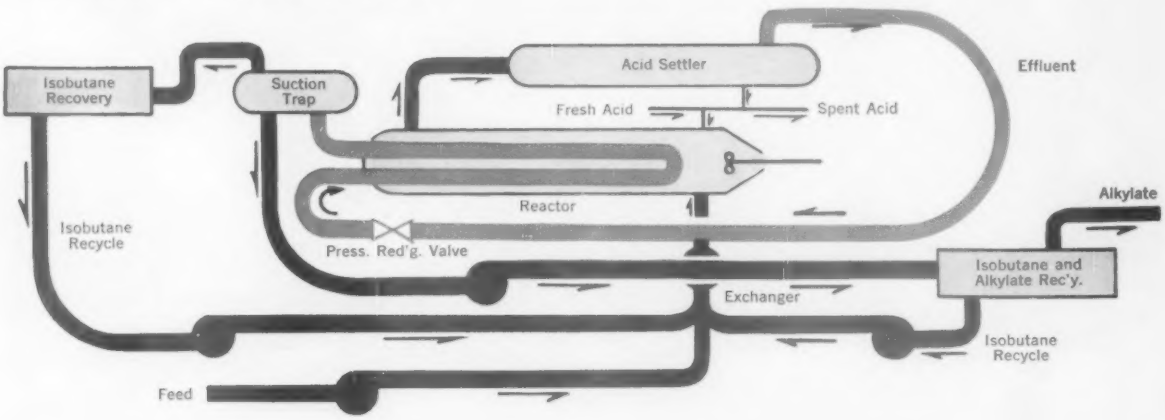
Watertown 72, Massachusetts

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

LOW-COST alkylate

FOR MOTOR OCTANE

effluent refrigeration



H_2SO_4 consumption – as low as 0.3 lb per gal of alkylate

EFFLUENT REFRIGERATION, the most important advance in alkylation technology in 15 years, now classifies alkylation as a most valuable process technique for production of the higher octanes. A substantially decreased acid consumption, higher yield of higher octane and a reduction in fractionation requirements for motor alkylate production are the major factors responsible for this most important process improvement.

An effluent refrigeration alkylation unit designed by Foster Wheeler is now being constructed for a major mid-western refiner. Capacity, 3,800 bbl per day of motor alkylate.

Flow description: Feed, mixed with recycle isobutane, enters reactor through heat exchanger. Thorough agitation with sulfuric acid, and high-isobutane ratio maintain optimum reaction conditions. Total reactor effluent separates in acid settler, acid returns to reactor. Hydrocarbon effluent from settler flows through pressure reduction valve into cooling coils in reactor maintaining predetermined temperature therein. Vapor and liquid separate in suction trap. Vapor, mainly isobutane, is recovered and returned to reactor. Liquid is pumped through heat exchanger to fractionation system where recycle isobutane and product alkylate are recovered. For further information write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

Roebling Royal Blue Wire Rope will **bend** and **bend** and **bend!**

What's more, Roebling Royal Blue is *stronger* than the strongest wire rope previously available. It will do more work and last longer on *your* job. Call your distributor or your nearest Roebling office for full information about Royal Blue, the really better wire rope. John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Distributors, Branches and Warehouses Throughout the Country—Subsidiary of The Colorado Fuel and Iron Corporation

First . . .

George Washington, the first president, was first in war, first in peace and first in the hearts of his countrymen.

Year after year the Texas Employers' Insurance Association continues to be first with employers of labor in Texas, writing more Workmen's Compensation Insurance in Texas than its five principal competitors combined.

One reason for this popularity with Texas industry is the Association's low-cost plan of operation which has enabled it to save and return more than forty-nine million dollars to its policyholders in Texas.

Are you, like others in the Oil and Gas Industry, taking advantage of these SAVINGS?

Over
$49,000,000
Saved and Returned to
POLICYHOLDERS

TEXAS EMPLOYERS
INSURANCE ASSOCIATION

HOME OFFICE • DALLAS, TEXAS

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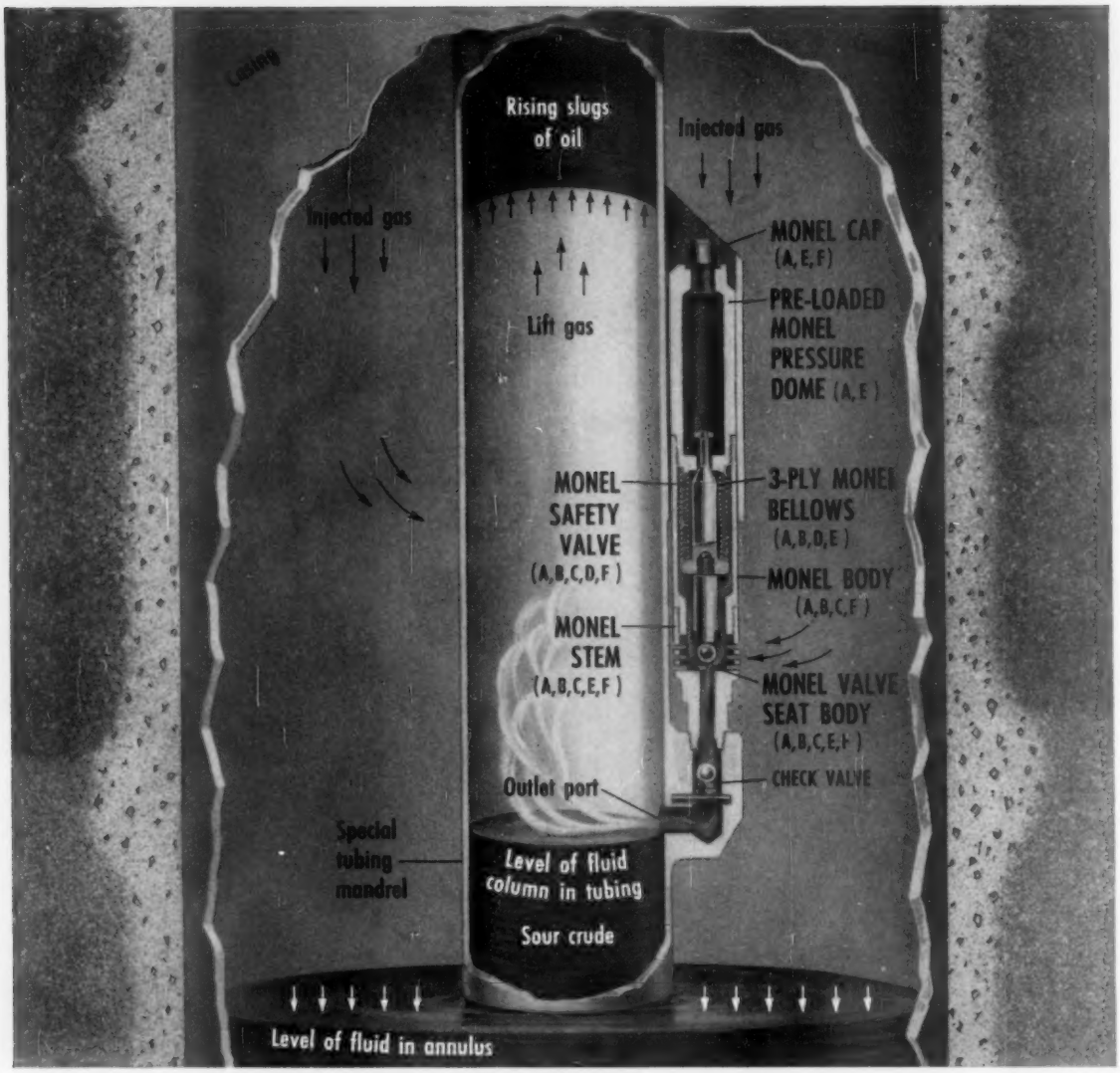
A. F. ALLEN, *Chairman of the Board* BEN H. MITCHELL, *President*


Casing
Rising slugs of oil
Injected gas
Injected gas
Lift gas
MONEL CAP (A, E, F)
PRE-LOADED MONEL PRESSURE DOME (A, E)
MONEL SAFETY VALVE (A, B, C, D, F)
3-PLY MONEL BELLOWS (A, B, D, E)
MONEL BODY (A, B, C, F)
MONEL STEM (A, B, C, E, F)
MONEL VALVE SEAT BODY (A, B, C, E, F)
CHECK VALVE
Outlet port
Special tubing mandrel
Level of fluid column in tubing
Sour crude
Level of fluid in annulus

How Monel improves the Guiberson gas-lift valve

A. Resists corrosion by sour crudes — B. Withstands wear of sand particles — C. Forestalls erosion by fluids — D. Overcomes fatigue in bellows — E. Stands up under pressure stresses — F. Absorbs impact during setting

This valve is surface-adjustable for a continuous or intermittent flow. For further information, write The Guiberson Corporation, 1000 Forest Ave., Dallas, Texas.

With Monel nickel-copper alloy, the Guiberson gas-lift valve is better able to withstand sour crudes and other well corrosives.

*Registered trademark

Monel* and other Inco Nickel alloys are used in thousands of locations and many different types of drilling and refining equipment. *They have proven uniquely resistant to corrosion, and well able to meet a wide range of severe physical requirements.* For assistance in their application, contact Inco's Development and Research Division.

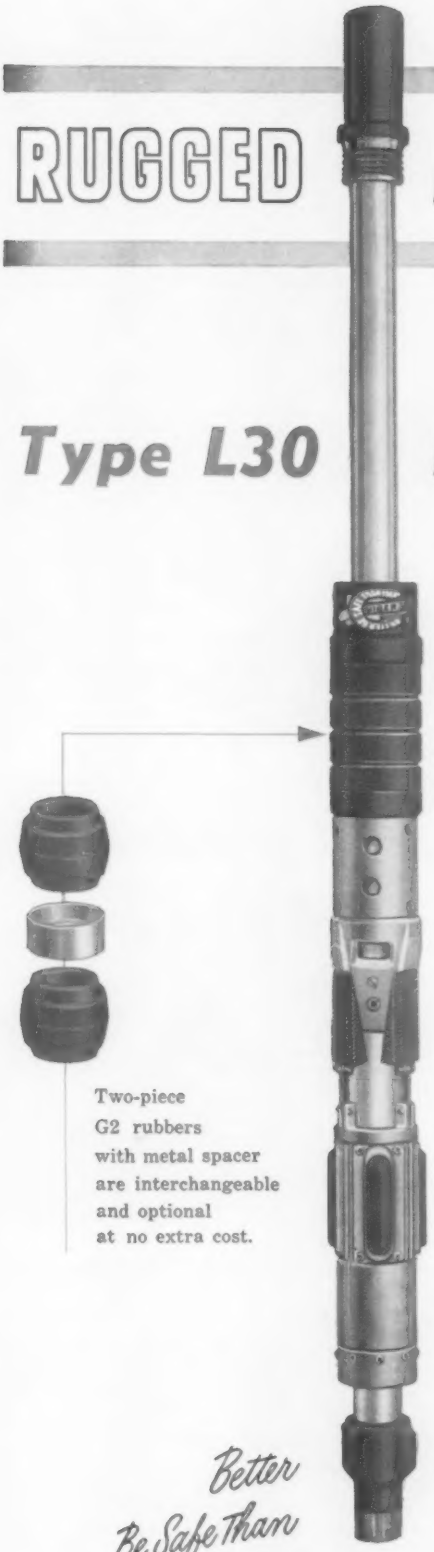
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street — New York 5, N. Y.

INCO TRADE MARK **Nickel Alloys**

RUGGED AND RELIABLE

GUIBERSON'S

Type L30 Deep Well Packer



Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost.

For deep well work with high temperatures and pressures, use Guiberson's dependable L30 Packer. It will give you long valve travel (30 inches) with minimum overall length at no extra cost. You can pull the L30 surely and safely. The fast-action automatic latch, protected by a positive anti-lock device that assures ready release, snaps easily into latched position. Tough, long-wearing friction pads supply ample drag. Packing rubbers of advanced design will not vulcanize to the casing wall. All these features are available on the L30 or the L8 with 8" valve stroke in a wide range of casing sizes. For circulating *above* the packer, Type L30P or L8P with perforated mandrel is available.

Better Be Safe Than Sorry

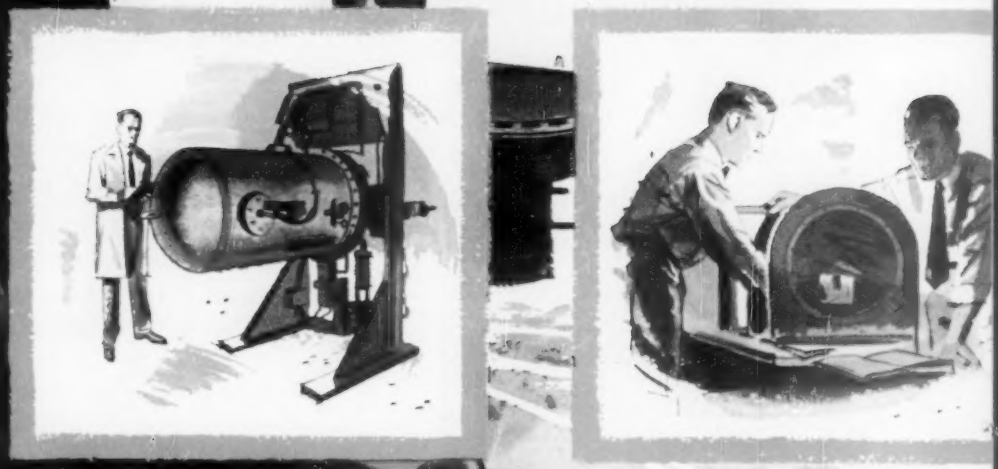
THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by
Oil Field Supply Stores
Everywhere

To help you produce

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION



The future is the research engineer's today

oil cheaper P.E.S.A. members invest one hundred million dollars a year in **RESEARCH**

Jules Verne's "Eighty Days Around the World" was once regarded as a tale to stir the imagination of youngsters. But change outran Verne's imaginative story, making his predictions conservative indeed. Present day prophecies are even more breathtaking.

P.E.S.A. members are not startled at these fabulous prognostications, for their own scientists are predicting vaster things to come in the oil industry. They will not only keep up with the requirements of the industry but in many instances they will be ahead. We have only to look back twenty-five years to note the remarkable advances that have been made. Petroleum equipment manufacturers, supply companies, and service companies were in the vanguard of this progress.

The driving force of the free enterprise system is what has made these scientific conquests possible. The pioneering and inventive accomplishments of P.E.S.A. members year in and year out typify boldness and initiative in solving problems that would discourage lesser men.

The hundred million dollars a year that P.E.S.A. companies invest in research is assurance they will continue to develop new tools and methods and have them ready when and where needed.

Composed of: manufacturers whose plants make the finest precision equipment . . . *supply stores* who add two other ingredients of value—where you want it—when you want it . . . *service companies* who make available to their customers the practical results of the theoretical research of some of the most brilliant scientific and technical men in the world.

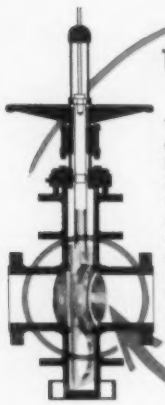
P.E.S.A.*

*Petroleum Equipment Suppliers Association

6512

BIG LINES take BIG VALVES

This 34" ASA-400 full opening high pressure Grove *Seal-O-Ring* Gate Valve with the fabricated steel body is one of a series already in service on one of the nation's major gas pipelines. Its huge free-sliding non-wedging gate is actuated by a hydraulic piston operating on pressure from the line. Grove *Seal-O-Ring* Gate Valves – now thoroughly proved in the field – are available from 2" to 36" in all standard pipeline pressures for gas or liquid service.



THE WHOLE VALVE IS RIGHT HERE

When valve is full open or closed, bubble-tight seals on both sides of the gate completely isolate line pressure in the conduit. The body, serving merely as framework for operating mechanism and to prevent loss of product while gate is in motion, may be drained or vented to atmosphere when gate is open or closed. Integrity of seals can be checked any time by a tell-tale valve on the body.

701

GROVE SEAL-"O"-RING Gate Valves

SUBSIDIARY OF WALWORTH

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, Calif.
HOUSTON 4—1901 Calumet St. • • • • • **LOS ANGELES 6**—1930 W. Olympic Blvd.

GROVE SEAL O RING ® GROVE SIMPLICITY ACCURACY SAFETY

ODESSA, TEXAS • TULSA, OKLAHOMA • DENVER, COLORADO • In Western Canada: GROVE VALVE LIMITED

Chalk for the doghouse blackboard is our business, too!

Recently, one of the National Supply Stores that serves an especially active area had several requests for chalk. Toolpushers wanted it for writing on their doghouse blackboards. So we promptly stocked a quality grade of dustless chalk, and it's now "moving" very well.

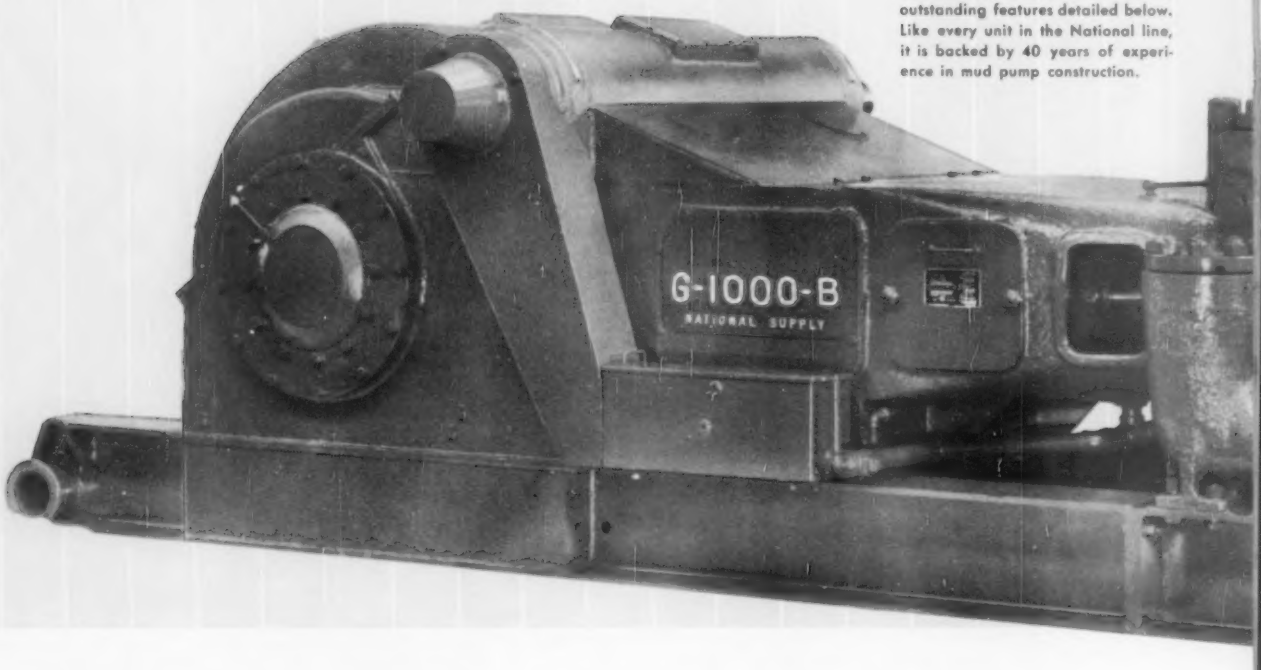
This is typical of the effective supply service available from every one of our 129 stores. No item is too small when you need it. In fact, we know that good store service on small items — as well as major equipment — is a "must."

Each National Store has a complete line of operating supplies that is tailored to the needs of the area it serves. A store's inventory is never static — but constantly changed to bring you the newest developments in appropriate products. When you ask for an item we don't have (like the chalk), we get it.

Moreover, we insist on top quality products — from the major equipment in our own "National Blue" products family to the smallest accessory item you can name. And, by anticipating your needs, we always try to eliminate delay and give you the best possible price benefits.

If you haven't stopped in a National Supply Store for a while, you're missing a profitable shopping experience. You can quickly see and select the products you need. Colorful displays and racks of well-illustrated product literature aid you. And you get the reliable personal service that has helped to make us the leading storekeeper to the oil industry.

THE
NATIONAL SUPPLY
COMPANY

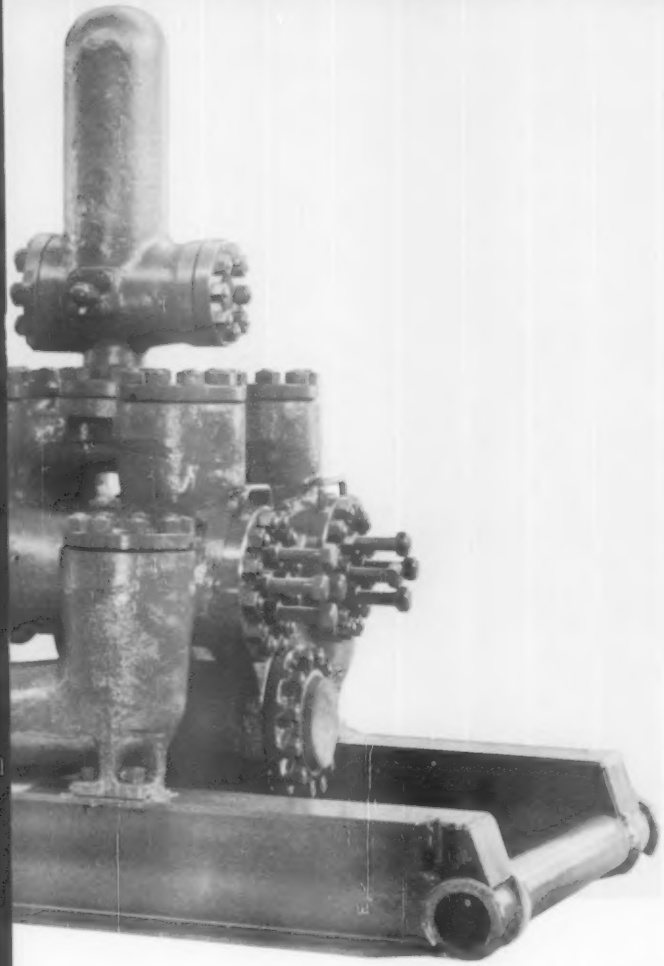


The G-1000-B, largest pump manufactured by National, has all the outstanding features detailed below. Like every unit in the National line, it is backed by 40 years of experience in mud pump construction.

These National slush pump features

- Advanced design gives greater horsepower per unit of weight.
- Main bearing* and connecting rod bearings are individually and consequently more accurately pre-loaded to reduce impact loading and eliminate slapping of bearings.
- Maximum frame strength with minimum weight made possible by the use of steel plates and steel castings electrically welded into one unit.
- Aluminum main frame cover and crosshead inspection covers.
- Long trouble-free gear life assured by sturdy construction of pinion shaft and crankshaft, minimizing deflection and maintaining proper gear tooth contact.
- Single helical gears. Forged steel pinion integral with shaft, and fully heat-treated fabricated steel gear* shrunk on crankshaft.
- Solid cast steel construction precludes connecting rod failures from loosening of bolts.
- Long life assured by replaceable crosshead slippers and crosshead liners.
- Intermediate rod cannot be accidentally unscrewed from crosshead by operating vibrations or by unscrewing piston rod because of locking pin which positively prevents rotation.
- Simplicity of the installation of the drive sprocket or sheave made possible by a tapered extension on each end of the pinion shaft.
- Grease packed bearings lubricated from outside the pump exclude crankcase oil.
- Gear splash and cascade lubrication eliminate necessity for a mechanical lubricator.
- Mud contamination of crankcase oil positively prevented by intermediate baffle wall and large deflector on the water piston rod lock nut.
- One piece cast alloy steel fluid end with no integral walls or baffles and with cylindrical sections. Minor damages reparable by welding.
- Minimum restriction to fluid flow and elimination of "dead" spaces in the suction assured by single suction connection and large, direct, smoothly curved passages.
- Valve cover plates and cylinder heads are sealed by lip type pressure actuated packing, allowing a metal-to-metal seat

*Patented



THERE'S A RUGGED

NATIONAL

SLUSH PUMP FOR

EVERY DRILLING NEED!

Type	Rated Max. Input H.P.	Rated Output H.P.	Rated Speed R.P.M.
D-50	80	68	75
C-100	150	128	75
C-150-B	220	187	70
C-250	370	315	65
C-350	600	510	60
G-700	700	595	70
G-1000-B	1000	850	65

insure low operating costs!

between these members and the pump body. This design permits uniform stud loads which reduces blowout hazard and stud breakage.

• A.P.I. metal ring gaskets at suction and discharge flanges.

• "Tell-tale" hole gives warning of liner sleeve leakage before any damage is done to the pump casting. No removal of any parts necessary to tighten liner sleeve packing.

• Type "G-1" NATIONAL valves are designed to provide a minimum of restriction to fluid flow, allowing more complete filling of the cylinders, thus minimizing shock loads on the working parts of the power end.

• "Nationaloy"liners and National Dual Seal pistons offer accurate clearances, excellent sealing action and long life. National "Blue Stripe" or "Blue Chrome" A.P.I. Rods are available in all tapers.

• Special design of skid end permits easy rigging of winch line without damage to skids. Heavy, well placed crossbracing in skids assures rigidity.

• Fluid piston rod stuffing box bores case hardened to retard wear caused by breathing action of the fluid piston rod packing.

• Alemite grease packed fluid piston rod stuffing boxes with Acme-threaded adjusting nut designed to increase the service life of piston rods and piston rod packings.

• Enclosed fluid piston rod lubrication assures longer, trouble-free service from piston rods and piston rod packings.

THE

NATIONAL SUPPLY

COMPANY

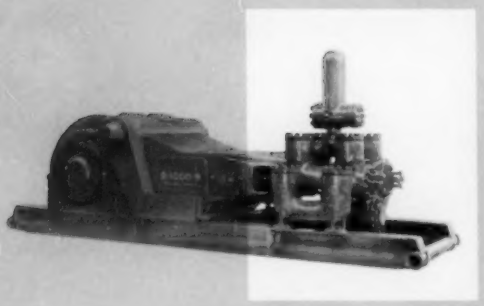
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

...and National fluid end parts to keep pump maintenance low!

see the next page

You keep pumping efficiency high with National Fluid End Parts!



Whether you use them in National Slush Pumps or pumps of other makes, you can count on National Fluid End Parts to give long service life, reduce replacement costs and keep pumping efficiency high. For these reasons, precision-made National Fluid End Parts have been important factors for many years in slush pump preventive maintenance programs throughout the world's oil fields.

You'll find these field-proven parts specially packaged to insure factory-checked quality when you install them. Their long service life is especially important in areas where operations are far away from normal supply lines. Order National Fluid End Parts from the National representative in your area.

"Blue Stripe" Piston Rod with API Taper

API Dual Seal Piston

Type "G-I" Valve and Seat

Valve Cap and Cylinder Head Packing

Cylinder Liner Packing

"Nationaloy" Cylinder Liner

Gaskets and Packing — Selected for resiliency and resistance to the effects of chemicals or temperatures.

Liners — Hard, precision-finished working surface for long life, plus carefully-controlled outer dimensions insuring proper fit in pump cylinders.

Rods — Metallurgical control insures maximum resistance to abrasion, corrosion and wear.

Pistons — are made of a tough, resilient rubber, molded on a solid metal core to create a positive seal. The replaceable cup-type "Dual Seal" piston with API tapers is the latest addition to this National family. Replaceable cups on opposite ends of the "Dual Seal" insure a positive seal.

Valves and Seats — Maximum opening for fluid flow assures complete filling at high speed.

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

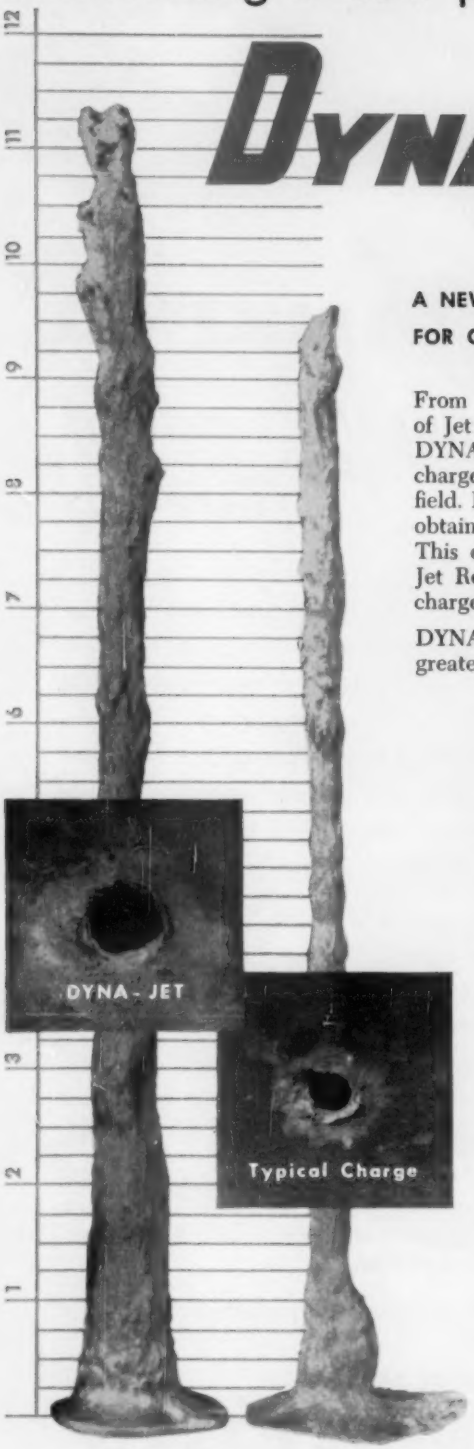
announcing a new product of research . . .

DYNA-JET*

A NEW SHAPED CHARGE
FOR OIL WELL PERFORATING

From the modern research laboratories and proving grounds of Jet Research Center, Inc., comes the announcement of the 4" DYNA-JET charge for use in hollow carriers, a new shaped charge that out-performs any present typical 4" charge now in the field. Larger entrance hole and greater penetration is obtained with DYNA-JET through a radically different design. This design is the result of cooperative effort between Jet Research Center, Inc., world-wide headquarters for shaped charge research, and Stanford Research Institute.

DYNA-JET is conclusive proof that industry can look to JRC for greater utilization of shaped charges through research.



DYNA-JET PACKS MORE POWER

Tests prove that the DYNA-JET charge will out-perform any presently available charge of comparable size. In side-by-side tests fired under fluid with ½-inch clearance and shot into a composite target consisting of 14#/gal. neat cement with 1% Bentonite aged 16 days and faced with 5½"-17# N80 API casing, the following comparative results prove the superiority of the DYNA-JET:

DYNA-JET		Typical Charge
0.58"	Entrance Hole Diameter	0.40"
11.28"	Total Depth Penetration	9.66"
38.4 cc	Hole Volume	12.6 cc

This means the DYNA-JET charge out-performs existing perforating charges by giving:

111 % more hole area
16.8 % more depth of penetration
205 % more hole volume

and assures more drainage area for maximum recovery. DYNA-JET gives a cleaner hole free of carrots. This new 4" charge is available through jet process licensees. Other sizes will be available soon.

Casts made of holes in test targets show the increased entrance hole and greater penetration obtained with the DYNA-JET.

GREATER PERFORATING POWER
THROUGH RESEARCH

JRC

JET RESEARCH CENTER, INC.
*Trademark.

JET RESEARCH CENTER, INC.

P. O. BOX 246, ARLINGTON, TEXAS
PHONE CR 5-2864

for cooling tower application...

There's MORE protection against humidity in Allis-Chalmers MOTORS

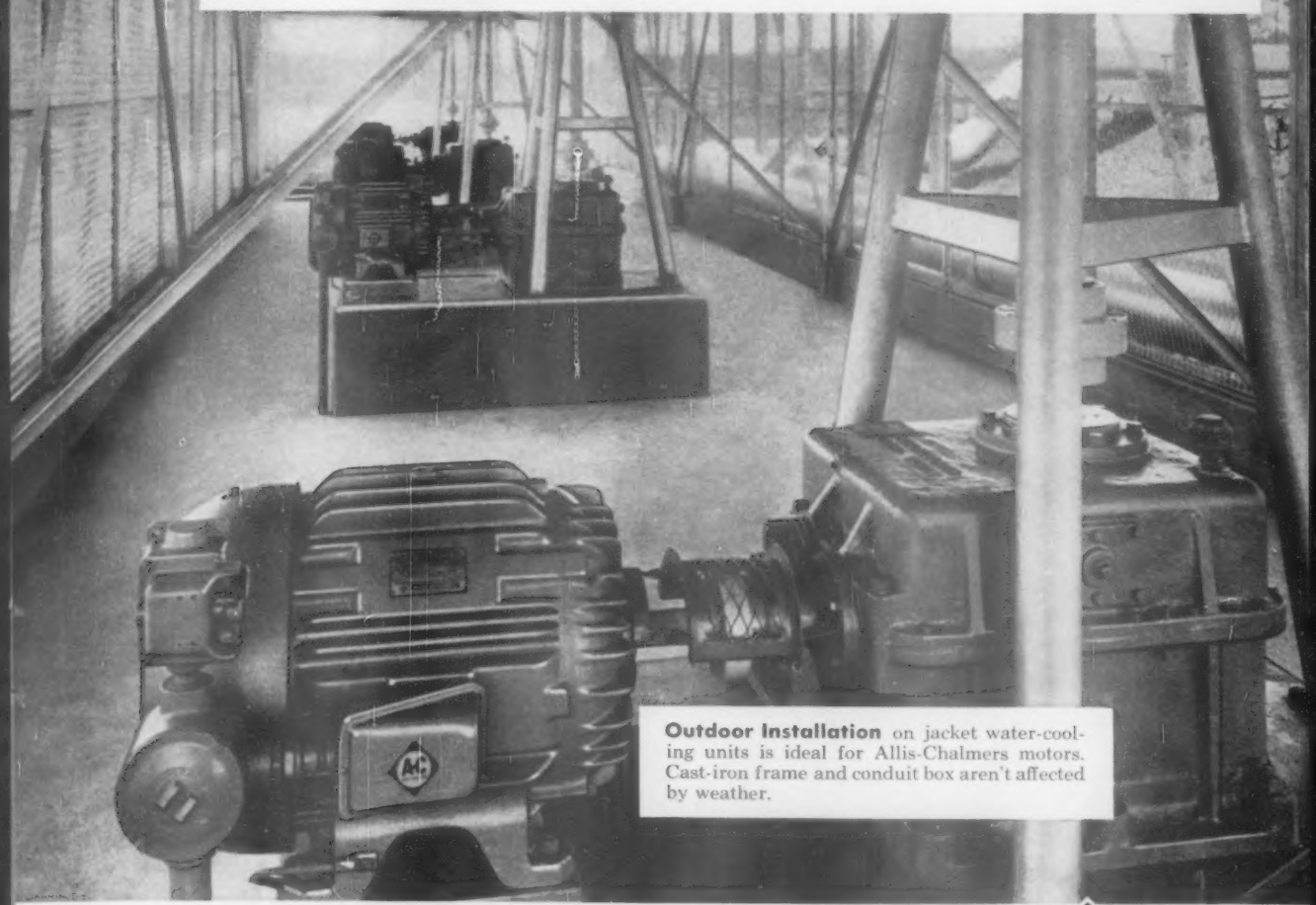
The ultimate in protection against high humidity — major cause of cooling tower motor failure — is provided tower builders and users in Allis-Chalmers TEFC motors. Here's why:

1. **Moisture drainage** — Drain plug can be removed to eliminate condensed moisture in the motor. (Particularly helpful in intermittent operations where condensation is more likely.)

2. **Extra-insulated stator** — Several applications of special insulating varnish plus repeated baking keep humidity out . . . give the long electrical life you need.

3. **Weather-protected bearings** — Rotating seal, turning in close running clearances, guards against entry of water.

Find out more about the "MORE" in Allis-Chalmers motors by contacting your nearby A-C sales office or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.



Outdoor Installation on jacket water-cooling units is ideal for Allis-Chalmers motors. Cast-iron frame and conduit box aren't affected by weather.

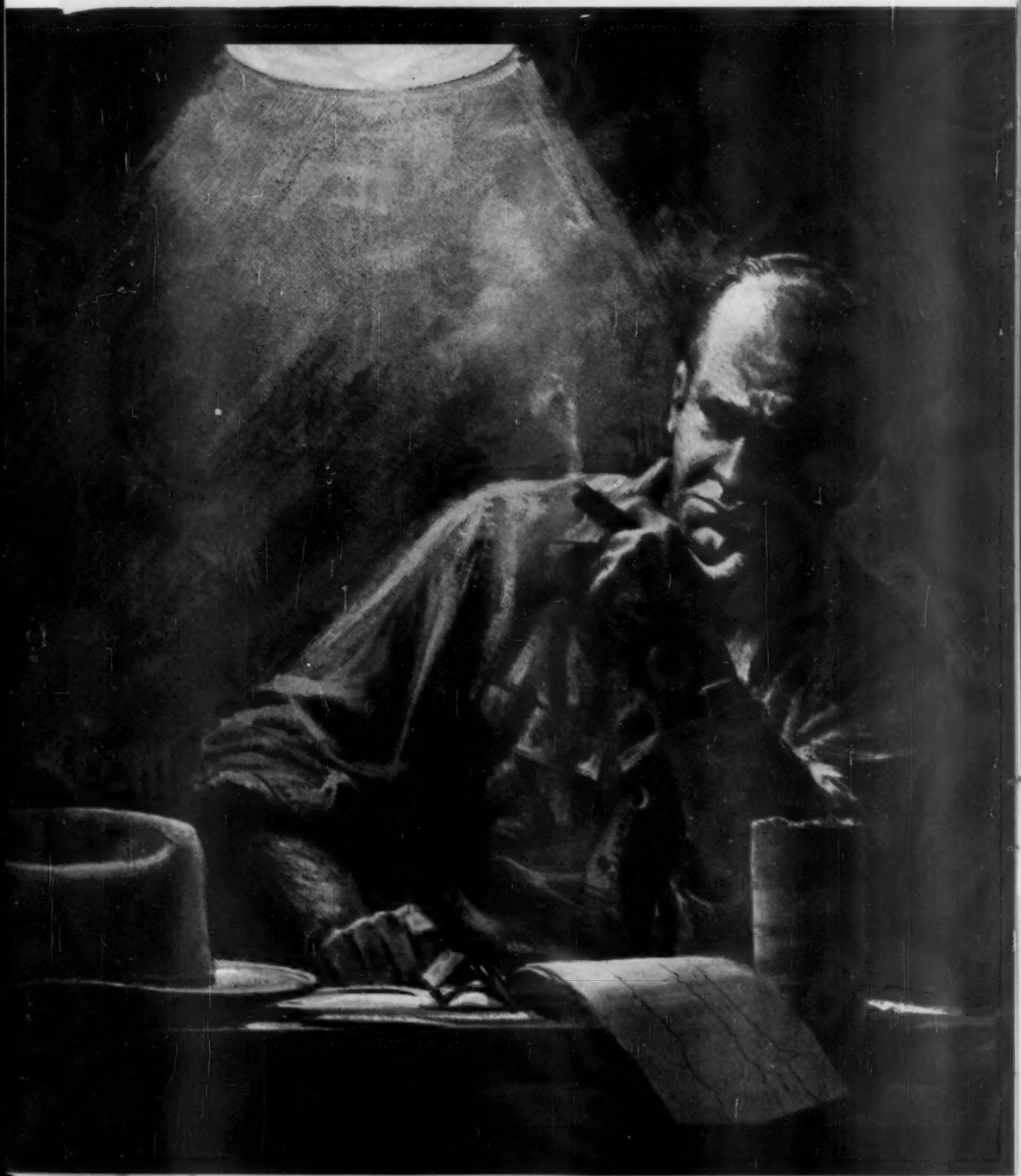
ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5183

Source A - subsurface data indicates oil

Source B - subsurface data indicates water



ALLIS-CHALMERS

A-5183

What to do?

Johnston test and be sure !

Maybe you have been in this fellow's shoes.
Two highly dependable sources of formation data present conflicting views as to the possible productivity of a formation. It doesn't happen often, but when it does happen the operator is on the spot.
What to do? The obvious answer is a Johnston Test.
Not just any drill stem test . . . a Johnston Test.
For by no other means, short of a permanent completion, can the operator be absolutely sure that the formation in question is carrying oil in commercial quantity, or water.
A Johnston Test costs no more than an ordinary drill stem test, yet it is the most accurate of all. The famous Tension Type Spring in the Johnston Tester is so sensitive it faithfully records formation pressure changes of as little as 5/100 of 1 per cent! And since the time and temperature elements are so important in the precise calculation of formation pressures, a sturdy chronometer and dependable thermometer are built into the Johnston Tester.
There's no guesswork . . . no approximation.

JOHNSTON TESTERS

first in drill JOHNSTON **stem testing**

P. O. BOX 98,
HOUSTON, TEXAS
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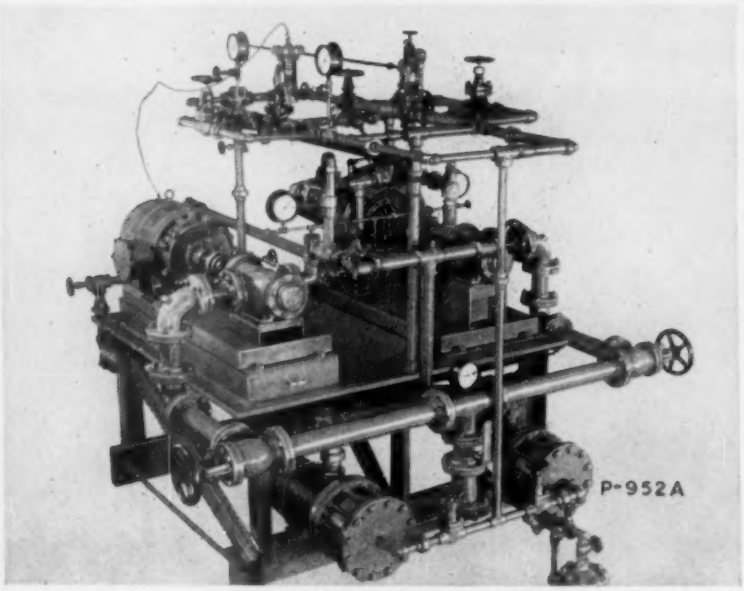
THERE'S A DIFFERENCE IN DRILL STEM TESTING . . . AND JOHNSTON MAKES THE DIFFERENCE!

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING *AND* HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

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STEAM ATOMIZING OIL BURNERS
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DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
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SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

They Say—

Three New Year's Problems

"In approaching the new year, the industry faces three major economic problems . . .

"First, there is the problem of working off the large gasoline inventories which have accumulated during the year . . . This problem is particularly distressing because it is one that could easily have been avoided through more prudent management of refinery operating schedules. A second problem facing the industry . . . will be that of working out arrangements to relieve the shortages of petroleum products in Europe which have been caused by the trouble in the Middle East.

L. F. McCOLLUM

"In our efforts to help Europe, we should guard against precipitous measures which might impair the health and vitality of the domestic industry. Crude-oil stocks in this country were excessive at the time of the Suez crisis. Some withdrawals should be made, particularly from the high stocks in inland areas, before domestic crude-oil production is increased to any material extent. Otherwise, we may experience aggravated crude surpluses inland while running short in coastal areas.

"Finally, the oil industry will carry into the new year the burden of rising oil finding and development costs, which, during the past 3½ years, have not been relieved by any advances in crude-oil prices. The world-wide shortages of crude oil arising from the Middle East situation and the upward trend in oil finding and development costs may, therefore, soon bring the crude-oil price advances which have been in the offing for many months."

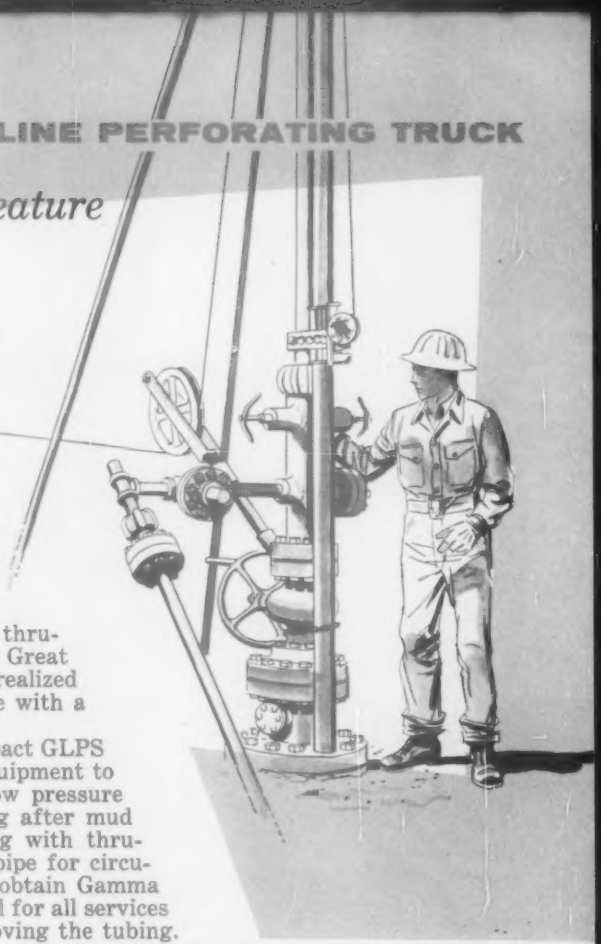
L. F. McCollum, president, Continental Oil Co., in a year-end statement.

Ratable Take in Texas

"The traditional Texas principle of ratable take, across the entire statewide producing structure, is the only policy under which the full strategic potential of Texas oil reserves can be realized. Departure from ratable take would operate diametrically against the national interest because it would sacrifice our own long-term national defensive capability for the sake of a very temporary expediency.

THE GLPS THRU-TUBING 3/16" LINE PERFORATING TRUCK

contains every special feature you have asked for!



Now . . . a completely versatile and self-sufficient thru-tubing unit, specified by you, and job-engineered by Great Lakes Petroleum Services, provides heretofore unrealized efficiency in the completion of wells under pressure with a wire line.

Requiring no derrick or work-over rig, the compact GLPS 3/16" line unit contains all the necessary special equipment to perforate under pressure . . . complete wells in low pressure reservoirs . . . eliminate mud blocks by perforating after mud displacement . . . protect reservoirs by perforating with thru-tubing completions . . . perforate tubing and drill pipe for circulation . . . dump cement at any desired depth . . . obtain Gamma Ray-Neutron log . . . maintain precision depth control for all services . . . and perform remedial perforating without removing the tubing.

HERE ARE THE EXCLUSIVE GLPS-DEVELOPED INSTRUMENTS AND EQUIPMENT FOR THRU-TUBING OPERATIONS!

- **Ultra-sensitive 1⅜" O.D. electric Collar Locator provides precision depth control—collars are noted by sight and sound plus a strip chart collar log that is made for your files.**
- **Precision electronic Weight Indicator helps prevent over-running line which aids in accurate depth control.**
- **Positive contact Measuring Sheave makes line measurements for the first time correlate with the measurements made by radiation log in casing.**
- **Special 1-11/16" O.D. Radiation Detector provides Gamma Ray-Neutron log unequalled in sharpness and clarity.**
- **Electrically actuated 1¾" O.D. Dump Bailer places cement at any depth desired.**
- **GLPS Super X Gun—1¾" O.D., a fixed-charge, bottom-fired, expendable aluminum jet gun, minimum junk—penetration equal to large diameter jet guns. (GLPS also offers all popular size thru-tubing swing jet guns.) All GLPS thru-tubing guns are bottom fired. The seven sequence switch positions on the control panel insure maximum SAFETY on every GLPS job.**

Call the nearest GLPS service center for your next thru-tubing completion or remedial job . . . and be confident that you have the most advanced wire line equipment available working on your well!

LEARN ABOUT ALL THE GLPS WIRE LINE SERVICES . . . write today for this new illustrated brochure!

Great Lakes Petroleum Services

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Odessa Phone FEderal 2-6491

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the most surveyed well in the world is right in Schlumberger's "backyard"

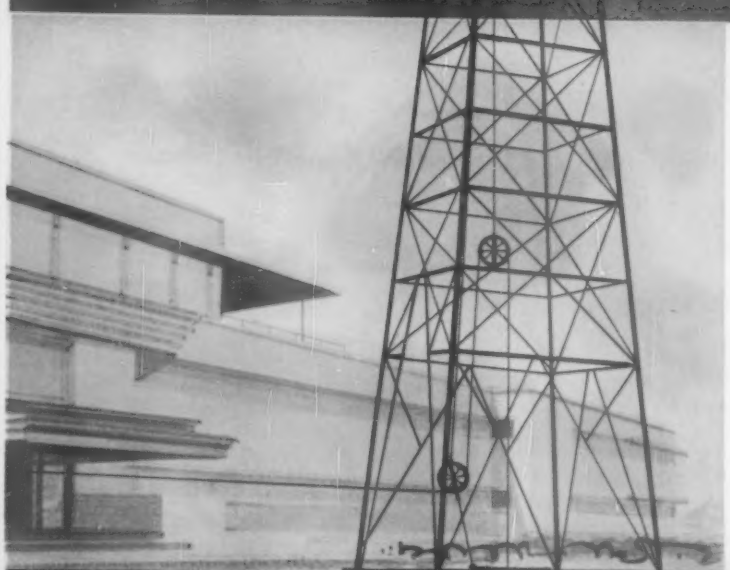
It is our specially constructed test well, completed in 1948. Since then, more than 6500 test surveys have been run . . . more than two-a-day every day of the year.

Nearly 800 complete Schlumberger Field and Off-shore Units have logged time at this test well in the past 9 years. It is specially constructed so that the test engineer can run actual down-the-hole surveys. Thorough check-outs are given every Schlumberger instrument control panel and recorder. This has involved the logging of more than 5,200,000 feet of hole.

In combination with this test well and other field simulated conditions in our laboratories, every Schlumberger Field Unit has proved its accuracy and dependability before it rolls up to your well.

The purpose of this exhaustive pre-field testing program, of course, is to insure the very highest quality field performance . . . Schlumberger quality . . . from the very beginning.

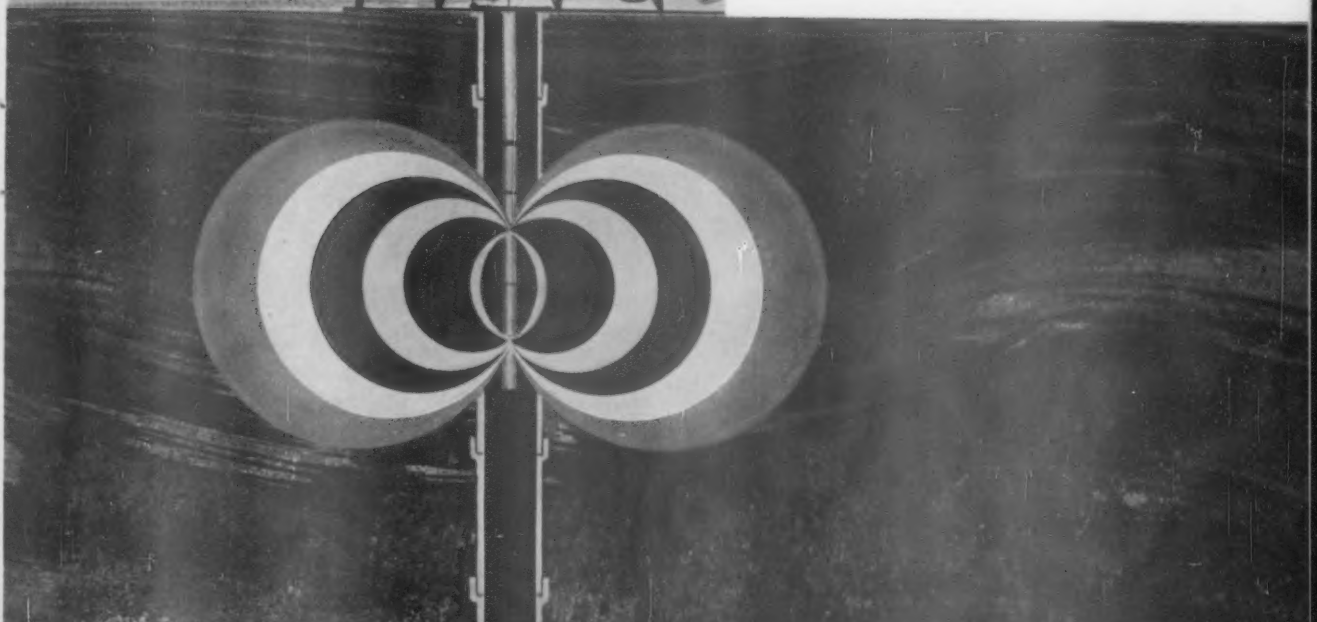
Schlumberger...to be sure!

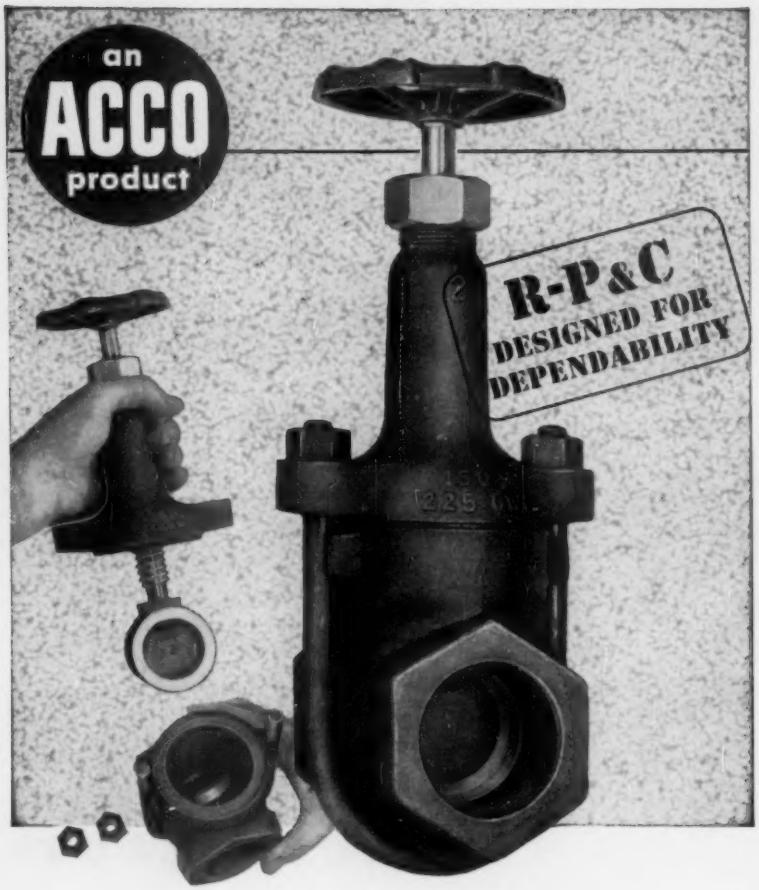


SCHLUMBERGER

WELL SURVEYING CORPORATION

THE EYES OF THE OIL INDUSTRY





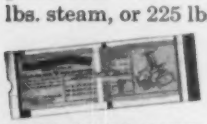
for Easier Cleaning!

—R-P&C IRON BODY CLIP GATE VALVES

• R-P&C clip gates were developed specially for those applications in the chemical and petroleum industries where ease of cleaning is a big factor. With these rugged valves you simply remove two nuts, then lift up the bonnet, stem and gate assembly in one piece for easy access to the entire valve body.

Ease of maintenance and sturdy construction make these clip gates preferable over bronze gate valves in many applications. Rated for 150 lbs. steam, or 225 lbs. OWG, clip gates are furnished in sizes from ¼" to 3", with screwed ends. Normally furnished with bronze trim, they may also be supplied in all-iron for use with fluids which attack bronze.

All castings used are of close-grain, hi-test gray iron, 50% stronger than ordinary iron, from R-P&C's own foundry. Their construction embodies quality features that are characteristic of R-P&C's complete line of gate, globe, angle and check valves in all of the standard valve materials.



FREE SLIDE RULE

Valve selector slide rule gives all dimensions for iron body and steel valves in pressure classes from 150 to 1500 lbs. Write for yours.

See your R-P&C Distributor or write for catalog

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

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R-P&C valves

"Selective buying would place a premium on the most readily accessible reserves. These purchases, if continued for any time, would result in the depletion of tidewater fields for future emergencies. In time of war, we would find our most accessible reserves already gone. Thus, we would have impaired our American wartime logistic flexibility for the doubtful peacetime convenience of our British and French allies.

"Selective buying also would constitute discrimination against inland production. Such discrimination would deprive the inland producer, and particularly the small independent operator, of a badly needed incentive for additional exploration and development, without which the state-wide strategic capacity cannot be maintained.

"Selective buying would result in the stagnation of our present crude-oil transportation system, which is now demonstrated to be inadequate for emergency use. Expansion of these facilities must be encourged, not retarded."

West Central Texas Oil and Gas Association.

Optimistic Look at Deep Drilling

". . . The present limits on deeper drilling rather obviously are not geologic. The continuing need to find new reserves for our oil-hungry economy would permit oil men to assume there may be oil down at those depths.

"Our present drilling limits, then, are defined more by engineering and economic problems. How to perfect our technical and mechanical operations so we can go deeper at tolerable cost, that is the question.

"In the past this has been done by close cooperation between the oil industry, the tool and equipment industry, and the well-service industry. Continuation of this joint effort is almost certain to bring about the improvements needed to make deeper drilling possible."

C. E. Reistle, Jr., director and vice president, Humble Oil & Refining Co., in The Humble Way.

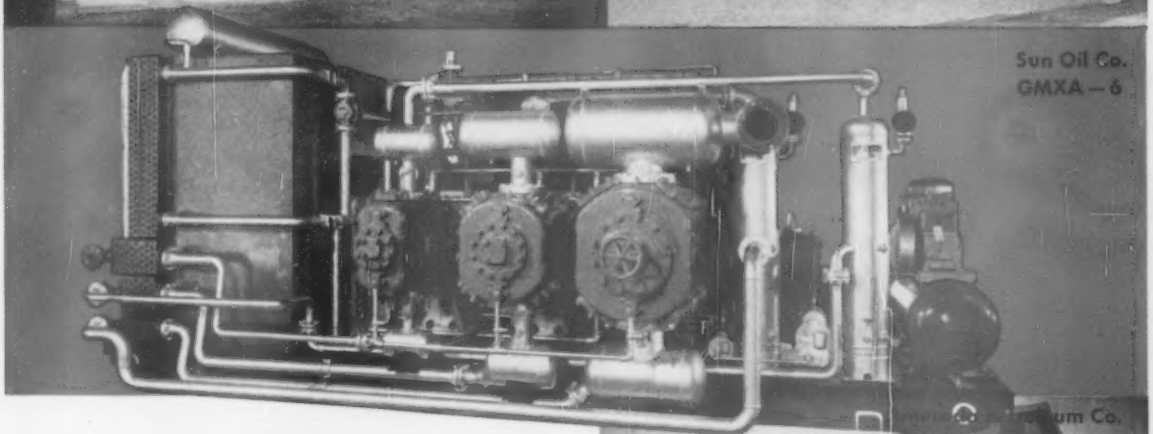
Fastest Growing Area

"Population and petroleum consumption trends have been rising in Canada at a rate more than double that of the U.S. And the southern Ontario-Quebec area is among the fastest-growing in North America. This development is certain to receive additional impetus from the building of the St. Lawrence Seaway, which will make available low-cost water transportation and additional low-cost electrical energy."

W. Alton Jones, chairman of the

Ohio Oil Co.
GMXA — 8

M. L. Mayfield
GMXA

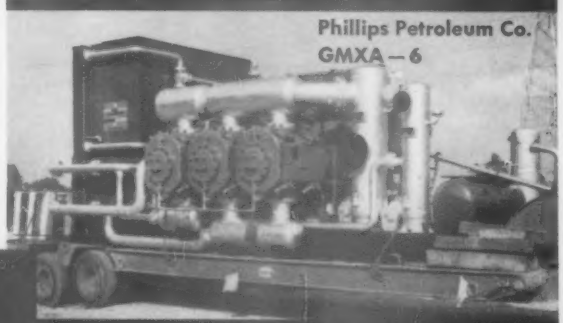


Sun Oil Co.
GMXA — 6

[illegible]um Co.
GMXA — 6

Southwest

DESIGNS, ENGINEERS AND BUILDS PACKAGED GAS COMPRESSOR PLANTS IN ITS OWN SHOPS AT HOUSTON

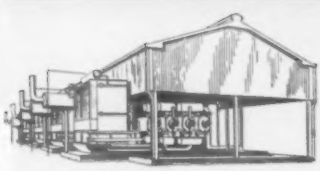


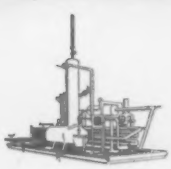
Phillips Petroleum Co.
GMXA — 6

SOUTHWEST INDUSTRIES, INC.

Post Office Box 7773, Houston 7, Texas

Partial view of Southwest shops in Houston





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OIC Valves, Bronze, Iron, Cast, and Forged Steel for all purposes.

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OIL STATES EQUIPMENT COMPANY
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THE GORMAN-RUPP COMPANY
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Centrifugal Pumps.

STEEL FORGINGS, INC.
Shreveport, La.
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HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Welding Couplings.

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WESTERN SAFETY BARREL STAND
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Stand lifts, holds, tilts 55 gal. barrels Prevents spillage—easily loaded.

MILLS IRON WORKS, INC.
Los Angeles, Calif.
Seamless Swage Nipples, Bull Plugs & Welding Reducers.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

board of Cities Service Oil Co., in a statement following announcement of Cities Service's plans to expand in Canada.

Progressive Climate

"If we make greater progress than Russia in science, it will be because such progress is best favored where there is freedom of individual thought and research."

Dr. James Creese, president, Drexel Institute of Technology, in a speech at the institute's anniversary convocation.

Oil's Risks and Taxes

"The oil industry is already burdened with taxation—both direct and indirect — far beyond any reasonable basis for what constitutes fair and reasonable taxation. A greater percentage of the oil industry's gross income goes for taxes than the average for all American industry today.

"I would challenge those politicians who criticize the oil industry's profits. I would like to take them into the cost accountant's office and show them what it costs to find the so-called fabulous pools.

"Oil hunting today involves a tremendous risk of large amounts of money against great odds . . . odds that no other business is required to take . . . You can never be sure of finding oil despite the best geological and geophysical brains and equipment in existence."

R. W. McDowell, president, D-X Sunray Oil Co., in a speech before the Kansas City Oil Men's Club.

Efficiency's Reward

"High corporate and personal income taxes restrict business growth—thereby penalizing efficiency. These taxes are not so much taxes upon big business as they are taxes upon the opportunities of a small business to succeed and grow large.

"High income taxes tend to foster monopoly by giving a preferred position to the established firm and hindering the growth of new small ones."

Robert G. Dunlop, president of Sun Oil Co., in a speech before Beta Gamma Sigma Alumni of New York.

Expanding Refining Capacity

"Jersey's affiliates throughout the world are experiencing a period of intensive refining activity to keep up with the rapidly growing need for petroleum products.

"In the past, these refineries have processed about 17 per cent of the free world's crude oil. Merely to keep this position, the Jersey organization

LEE C. MOORE TRAILER MOUNTED MASTS

DESIGNED
to fit your needs

Lee C. Moore designs trailer mounted masts to accommodate a wide range of drawworks and powers. Our close collaboration with other manufacturers assures the drilling industry of drilling rigs best suited to specific requirements.

SINGLE TRAILER MOUNTED MASTS

86 ft. 94 ft. 97 ft. 97 ft. Heavy duty 100 ft. 126 ft. Export model

DUAL TRAILER MOUNTED MASTS

97 ft. 100 ft. 126 ft.
126 ft. Export model

LEE C. Moore CORPORATION

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A SOLVENT
of Economy and Effectiveness

TENNESSEE CORPORATION

LIQUID SULFUR DIOXIDE
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annually builds additional refining capacity of approximately 200,000 bbl. a day because of growing markets."

Standard Oil Co. (N.J.), in a memo to shareholders.

CALENDAR

JANUARY

9-11 American Association of Oilwell Drilling Contractors, conference for drilling executives, University of Houston, Houston.

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

21-25 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

23-24 Northwest Petroleum Association, Nicollet Hotel, Minneapolis.

23-25 Instrumentation for the Process Industries, sponsored by Texas A. & M. College, chemical engineering department, College Station, Tex.

25-26 American Association of Petroleum Landmen, directors meeting, Hilton Hotel, San Antonio, Tex.

31-Feb. 1 Annual instrument short course of Southern California Meter Association, Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

7-8 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Lamar Hotel, Houston.

8-9 American Society for Testing Materials, Symposium on composition of petroleum, Jung Hotel, New Orleans.

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

15-16 National Society of Professional Engineers, spring meeting, Hotel Francis Marion, Charleston, S. C.

17-18 Engineers, Joint Council, Statler Hotel, New York.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

25-27 American Association of Petroleum Geologists, Rocky Mountain section, Rainbow Randevu, Salt Lake City.

27-28 Gas Conditioning Institute, sponsored by the University of Kansas extension, Southwest Kansas Center, Randall's, Liberal, Kans.

MARCH

3-6 American Institute of Chemical Engineers, regional meeting, the Greenbrier, White Sulphur Springs, W. Va.

6-8 American Petroleum Institute, Southwestern district production division meeting, Statler-Hilton Hotel, Dallas.

8 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

11-15 American Institute of Chemical Engineers, regional meeting, Philadelphia.

11-15 National Association of Corrosion Engineers, Kiel Auditorium, St. Louis.

12-13 Subsurface Geology Symposium, fifth annual conference, sponsored by the University of Oklahoma, Norman, Okla.

13-15 Society of Exploration Geophysicists, tenth annual mid-western meeting, Hotel Texas, Fort Worth.

20-22 American Petroleum Institute, southern district production division meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La.

25-27 Western Petroleum Refiners Association, annual meeting, Hilton Plaza Hotel, San Antonio, Tex.

27-29 American Power Conference, Sherman Hotel, Chicago.

APRIL

1-4 American Association of Petroleum Geologists, national convention, Kiel Auditorium, St. Louis.

2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.

7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.

7-12 American Chemical Society, national meeting, Miami, Fla.

8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

9-11 American Welding Society, fifth annual welding show, Convention Hall, Philadelphia.

10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.

Don't let vapor losses (or other thieves) steal you blind.

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770 VAPO-GARD THIEF HATCH VALVE

770-BP VAPO-GARD THIEF HATCH VALVE

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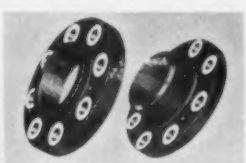

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Harrisburg Steel Co.
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11-13	American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.
16-18	Petroleum Industry Electrical Association, annual meeting, Shamrock Hotel, Houston.
16-18	Petroleum Electric Suppliers Association, Shamrock Hotel, Houston.
16-18	Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.
16-18	National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.
24-26	National Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.
24-26	American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.
25-27	American Association of Petroleum Landmen, third annual convention, Hilton Hotel, San Antonio, Tex.
28-30	Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.
29-30	Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.
29-May 1	Southern Gas Association, annual convention, New Orleans.

MAY

6-8	American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.
6-8	American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.
7	American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.
8-10	American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.
12-15	Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.
13-15	Industrial Waste Conference, sponsored by Purdue University, Purdue Memorial Union Building, Lafayette, Ind.
13-16	American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.
14-16	Industrial Nuclear Technology Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology and Nucleonics Magazine, Museum of Science and Industry, Chicago.
19-22	Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.
20-22	American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.
20-23	American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.
21-23	Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.
22-24	American Petroleum Institute, division of production, Eastern district meeting, William Penn Hotel, Pittsburgh.
23-24	Kentucky Oil and Gas Association, annual membership meeting, Hotel Phoenix, Lextington, Ky.

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He has to be! Your oil and gas well production problems are many problems. Sure, they all relate to greater recovery, but there's no one way to get it. That's why your Dowell man is an engineer, a geologist, an oil man.

That's why, in effect, the whole company moves in on your job. The Dowell man in charge becomes many men: our entire organization of engineers, geologists, and scientists. He gives you all of Dowell's specialized experience in formation treating and in the chemical cleaning of refining equipment. He makes certain that you get the best that Dowell can offer on every job.

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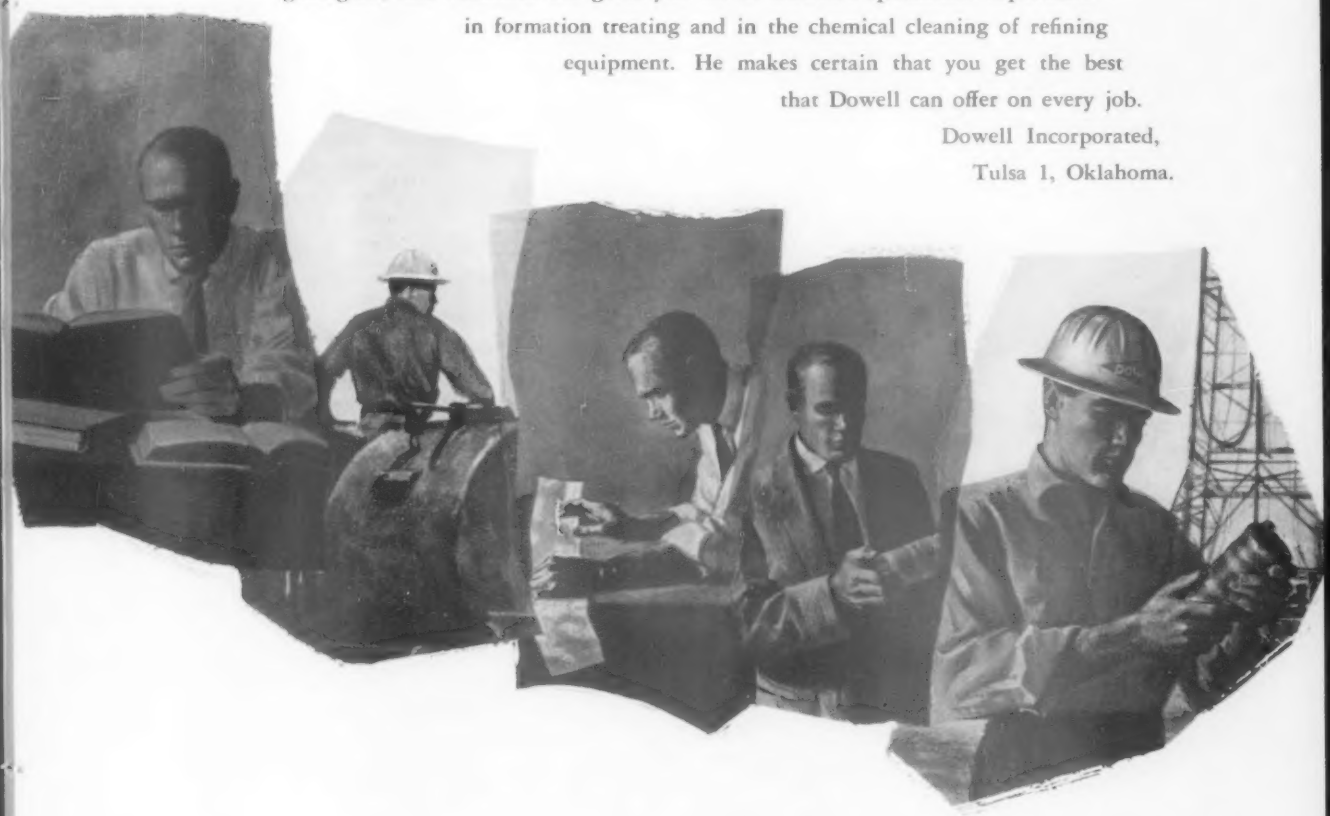

Services for the oil industry

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More power for greater recovery

Many operators are getting greater recovery from their oil and gas wells with the high injection rates of Dowell's new power-house pumpers. These 1500 h.p. Allison aircraft engines boost more fracturing fluid and sand farther back into the formation. Drainage area is greatly expanded. Payouts have been faster; reservoir values enhanced.

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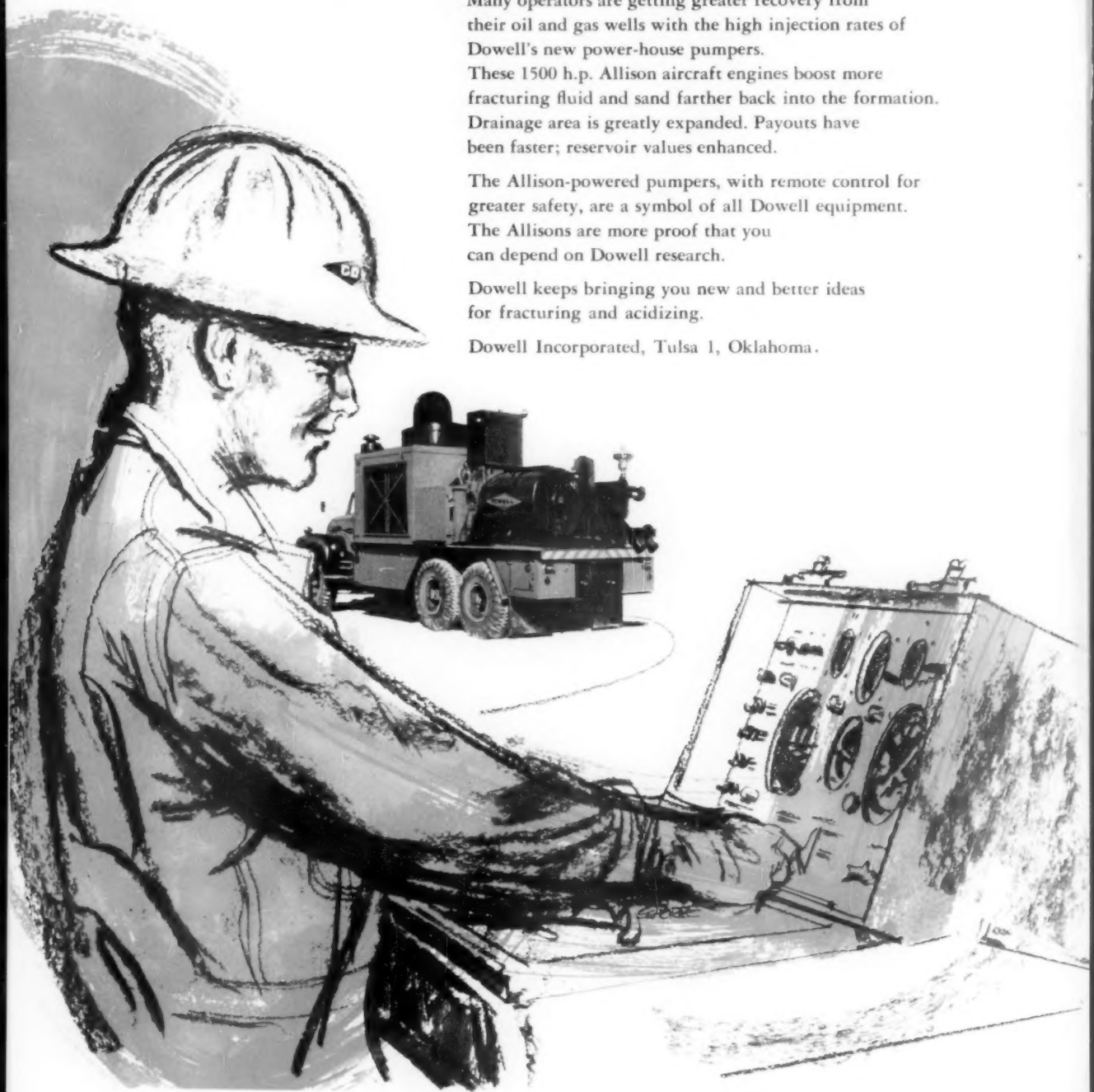

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Next Week East Lynne

A LUSH new field for fiction writers has been opened by the sensational newspaper stories about the theft of maps from Gulf Oil Corp. Look for a rash of mystery novels and Hollywood extravaganzas on the theme of "The Great Gulf Robbery, or the Case of the Missing Oil Maps."

The incident has fired the public imagination and fostered some bizarre misconceptions of the oil industry.

Unfortunately for the fictionmongers, it isn't typical of the oil business. Oil companies do depend on maps, just as a builder depends on blueprints. And they do try to keep plans secret from competitors, just as other industries try to conceal a still-unpatented chemical formula, or the design for next year's automobile body, or ladies' fashions, or a new cigaret advertising slogan.

An oil map by itself is worth no more than its printing cost—not "millions" as the newspapers would have it. To the ordinary person it would be harder to decipher than the coded treasure map in Poe's "Gold Bug." The real secret is in the minds of a few officials who know how the company evaluates the data that went on the map. Even a trained geologist couldn't put a map to use unless he had inside dope—and had managed to lease the right land first. Even then the chances are 10 to 1 that his wildcat would be dry.

Oh, sure, oil companies do have their confidential information stolen—but by employes who go into business on their own (sometimes without the good taste of resigning first). This happens every day. Just a routine, undramatic business hazard.

But that won't stop the scenario writers. This plot is too juicy to pass up.

It's a real thriller-diller, the way this Gulf yarn was played in the papers. It has all the elements of an old-fashioned melodrama — buried treasure, secret maps, stolen papers, international gangsters, gamblers, intrigue, bribery, blackmail, cloak-and-dagger sleuthing, and even a suspicion of murder.

Boy, oh boy, isn't the oil business exciting? It's all built around a map, just like the plot of "Treasure Island." The map shows the spot where a treasure of black gold—oil worth a fabulous fortune—lies buried waiting to be unearthed by the first comer.

Good treasure maps are hard to come by, so the best way to get into this fascinating oil business is to steal one from some other oil man.

If you can't manage that, you have a map made. You hire some bushy-haired scientists who manipulate mysterious instruments and utter incomprehensible words. They draw a crazy-quilt pattern of lines on a map, move their slide rules back and forth, peer through a microscope, and then make a tiny mark on the map, maybe with invisible ink. The X marks the spot where the gusher will be found.

Now your map is worth millions. You keep it locked up in a secret room, because you know that oil pirates, an international gambling syndicate, and assorted underworld characters are plotting desperately to snitch this key to untold wealth.

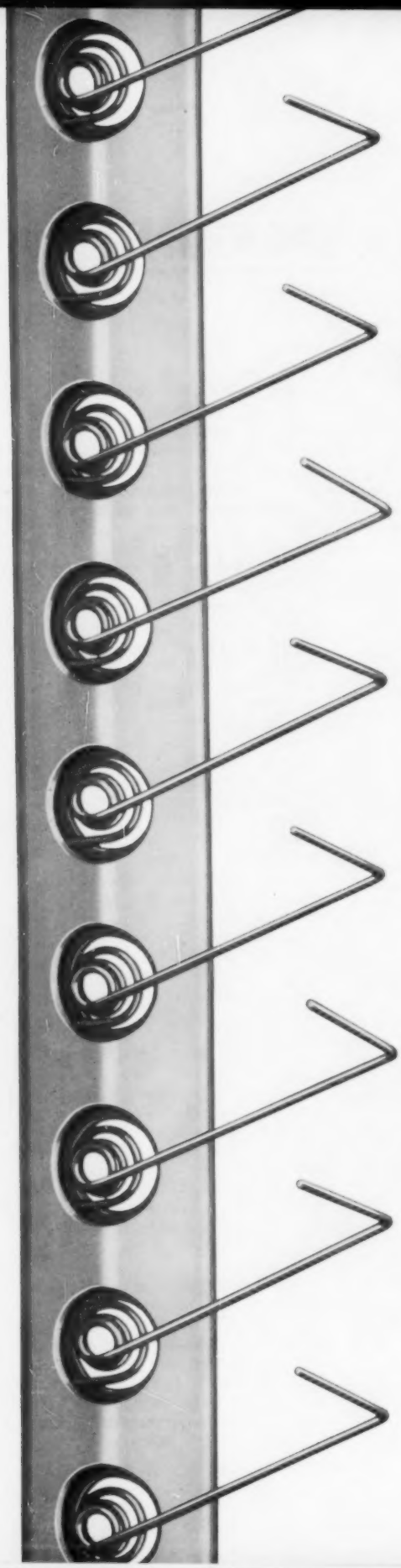
Maybe your map shows the X on a Pacific atoll, in the Congo jungles, or the heart of the Casbah. You organize a secret expedition, disguised as a picnic. You strap your map to your chest, hide a pistol and dark lantern under your cloak, and conceal a drilling rig under a tarpaulin.

But the dastardly map thieves somehow learn of your plans and get to the place first with what they think is a true copy of your map. Then comes the denouement. Their well is dry. They had miscalculated the clues to locating the X. Crime does not pay. They go back to easier forms of gambling, like marking cards and loading roulette wheels.

Meanwhile you have outwitted the villains and are secretly drilling in the right place. Your well comes in over the derrick. You wipe the greasy oil off your clothes, buy a private DC-7 airplane, and fly back just in time to lift the mortgage on the old homestead. Justice has triumphed. Fadeout.

Hollywood, take it away!

—Henry D. Ralph.



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NOT WHEN YOU USE **Baker** ***ROTATING* Wall Scratchers**

WITH "PLOW ANGLE" WIRES!

Operators who prefer "Rotating-Type" Scratchers will find the new Baker *ROTATING* Wall Scratcher (Product No. 903) far more effective than typical scratchers with "pointless" trailing wires. See in Fig. 1, how the right-angle bend at the ends of the wires in Baker *ROTATING* Scratchers provides a "plow angle" point which *must* dig in and effectively remove mud cake. Compare these results with the "pointless" action of trailing wires which are *merely dragged over* the mud cake without removing it; see Fig. 2.

Note also in Fig. 3, how the "plow angle" scratching point is maintained over a wide range of clearances—even under slim hole conditions—as each wire automatically adjusts to meet the wall of the hole.

Shock absorbing spiral springs, mechanically held by the *double* body thickness, prevent distortion of the scratcher wires both while running-in the hole and throughout the scratching operation.

Ask the Baker representative in your area for details of spacing and installation. Try this successful aid to "first-time" cementing.

If you prefer RECIPROCATING *Type Wall Scratchers, Baker Solid-Ring* SLIP-ON *Scratchers, or Baker* HINGE-LOK *Wall Scratchers will bring you* CONTROLLED SCRATCHING *by removing the mud cake only throughout the area to be cemented.*

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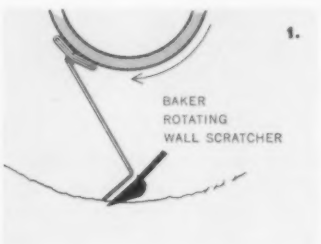
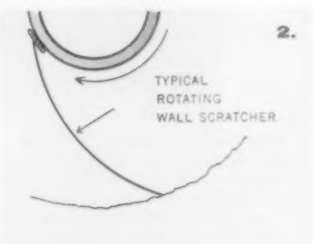
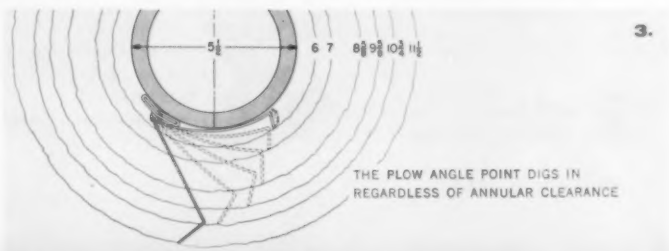






What 1957 offers oil

THE new year is starting out with conditions for the oil industry far better than anyone could have predicted 3 months ago.

Once again the industry's slide toward chaos has been slowed by the dramatic intervention of an outside factor rather than by its own good sense and wise planning.

The Middle East crisis came to the rescue just in time to forestall a crisis in the U. S. oil industry. It cut down imports, increased demand for crude, drained off some excess stocks, and opened the door to an improved price structure.

BUT IT'S ALL TEMPORARY. Some effects of the Middle East shutdown may linger for months, but the severe stage could be over by spring.

Certainly the end of winter can be counted on to ease the demand for oil. It always has. And by partial clearance of the Suez Canal or by other means, Europe's needs for U. S. oil may taper off.

What then? Will the domestic industry let itself slide back into the same old rut of excess production, unbalanced stocks, and a shaky price structure? The answer depends on how the industry makes use of the short-run emergency demand to prepare for the long-run period of near-normal conditions that should be anticipated.

Crude production has now been raised close to what appears to be the practical capacity of pipelines and barges. Holding it there will give an opportunity to work off stocks and underages, end purchaser proration, and hook up some unconnected leases.

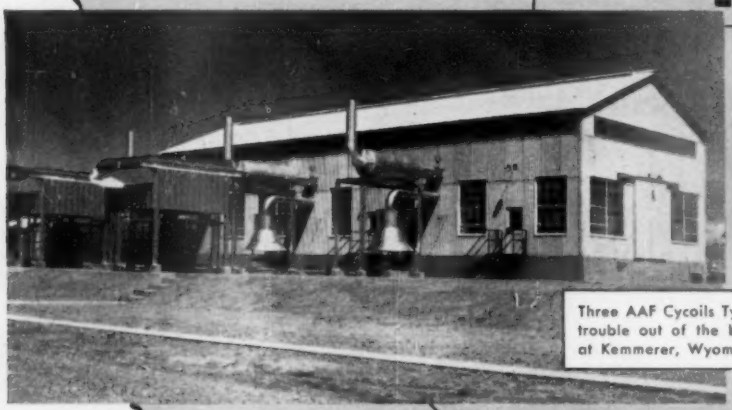
Once these sore spots are healed it will be easier to tell how much more allowables should be raised, if any. But in any event, producers should be aware that demand for crude could pass its peak relatively soon and that a return to overproduction will bring back the same old troubles.

Refiners, too, can use the emergency to work out of some of their troubles—if they add some good judgment. It should now be apparent that Europe prefers heavy products to gasoline. Instead of bemoaning this, refiners ought to roll with the demand punches. A shift in yield patterns would furnish what the market wants now without piling up gasoline stocks to price-depressing levels.

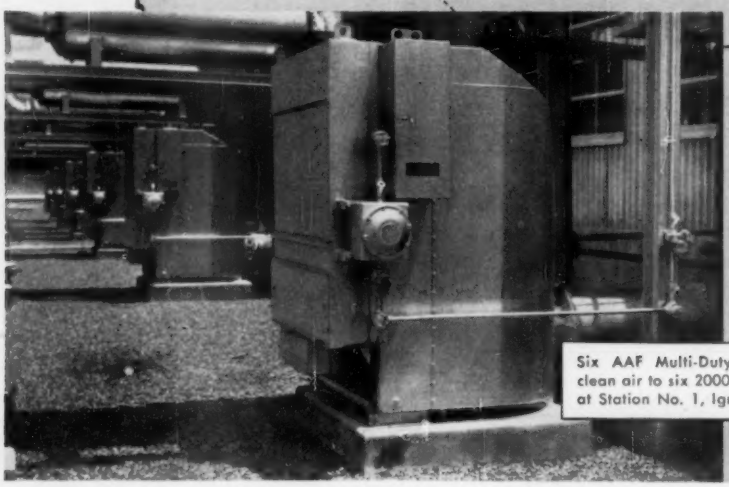
WHAT 1957 BRINGS to oil, therefore, will depend pretty much on what the industry itself does. The Middle East crisis is not a cure-all. But it does offer opportunities to make needed adjustments.

Weaknesses in the price structure are a case in point. If the industry hopes to correct them, it must utilize this transitory period of abnormal demand by working with the normal forces of supply and demand rather than trying to buck them.

$200,000,000 PIPELINE BY AAF CYCOIL AND



Three AAF Cycoils Type P keep dust trouble out of the big compressors at Kemmerer, Wyoming.



Six AAF Multi-Duty filters deliver clean air to six 2000 hp compressors at Station No. 1, Ignacio, Colorado.

PROTECTED EXCLUSIVELY MULTI-DUTY FILTERS

82,780 Compressor HP on Pacific Northwest System Depends Upon American Air Filter Equipment

When you're moving 393,000,000 cubic feet of gas per day over 2,571 miles of pipeline, you can't take chances with equipment failure! Pacific Northwest Pipeline doesn't. Every one of the huge compressors at the thirteen main line and two booster stations is protected against dirty air by AAF Cycoil and Multi-Duty filters.

Filter selection for Pacific Northwest was of prime importance. AAF equipment was chosen exclusively because AAF filters have proved their dependability in thousands of installations where dust-free air *had* to be provided for vital engines and compressors.

Uniform air delivery, constant efficiency, low operating resistance and infrequent maintenance are "musts" for true dust protection. If you would like more information on the way AAF delivers these advantages, consult your AAF representative or write to American Air Filter Company, Engine and Compressor Division, Louisville 8, Kentucky.

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Having designed these Oil-Well Cements to meet the entire range of Oil Industry requirements, outstanding performance is assured by continuous checking and re-checking throughout the process of manufacture, in one of the most exacting quality-control procedures in industry today.

Select cement to fit the job: 'INCOR',* America's FIRST High-Early, Sulphate-Resistant Cement...'STARCOR'* Slow-Setting Oil Well Cement...'TEXCOR'* Deep Oil Well Cement...LONE STAR Cement, standard of highest quality for half a century.

*Reg. U.S. Pat. Off.

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The Industry This Week

● **ECONOMICS:** The long-anticipated increase in the price of crude oil became a reality last week. Humble on January 3 posted new prices generally 35 cents higher than had been in effect for more than 3 years. The reasons: lack of available oil to meet demand; rising costs that had put the price of crude just about even with the cost of finding it. P. 75.

The industry can produce 9,000,000 bbl. a day, but 1,000,000 of this can't be moved with present facilities. This is the gist of a report made by an industry committee which set out to determine how well the U. S. could bridge the supply gap caused by the Suez situation. P. 82.

● **REFINING:** New process for upgrading their high-octane gasoline pool is now available to refiners. Called Iso-Kel, the process is designed to convert normal or straight-chain pentane and hexane to their higher-octane branched-chain isomers. Its operating advantages are flexibility, short payout. P. 76.

Octane ratings will continue their climb through 1957 just as they have for the last 10 years but the rate of increase may slack off. P. 88.

L.P.G. prospects remain bright for 1957. More plant and storage facilities are in the making after 1956 sales increased by more than a billion gallons, greatest increase in history. P. 92.

● **MIDDLE EAST:** Salvage work on Suez Canal is getting into full swing. The waterway should be open to small ships in mid-March and to normal traffic in May. P. 96.

Oil companies in Middle East are shelving projected construction programs because of reduced crude production following closing of Suez and pipeline in Syria. P. 96.

● **EXPLORATION:** Gulf's deep wildcat test in the Delaware basin holds title of world's toughest and orneriest hole in ground. Company in 5 years has abandoned, reentered and sidetracked the hole three times. P. 80.

Wildcat prices are zooming in the California tidelands. Socal and Humble have just made a joint bid of $7,250,000 for 5,500 acres. P. 77.

Expensive loss has been suffered by Shell in a storm off the coast of Qatar in Persian Gulf. Sudden wind and 20-ft. waves destroyed its offshore-drilling barge and killed 20 Arabian workmen. P. 95.

● **PRODUCTION:** A new shaped charge is giving jet perforators a bigger wallop. Newly designed charge opens a hole four times larger with same amount of explosives. P. 78.

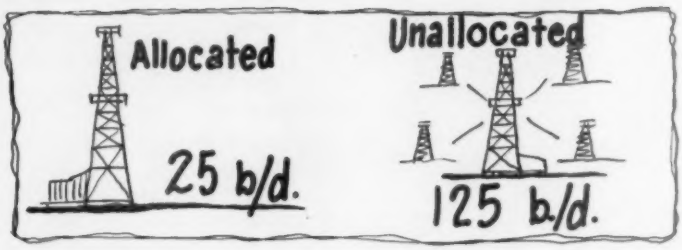
Oklahoma's proration system is blamed for the oil industry's failure to achieve generally good conservation in the state. Its inequities have led to general abuse of regulations. P. 72.

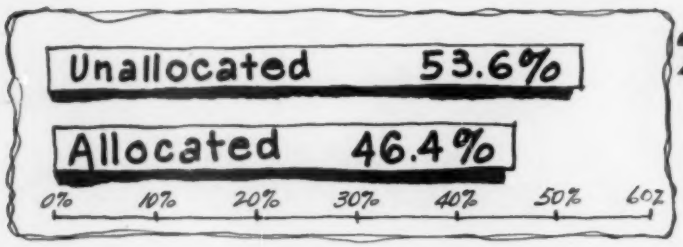
● **PIPELINING:** The Texas-to-Florida gas pipeline still faces tough sledding. FPC has given project conditional approval. But promoters first must revise their tariffs upwards and then talk customers into accepting them before final approval of the line can be won. P. 90.

Resistance of aluminum pipe to corrosion is being studied by Lavaca Pipe Line Co. in 8-in. gas line at Aluminum Co. of America's Point Comfort, Tex., plant. P. 82.

How proration can backfire:

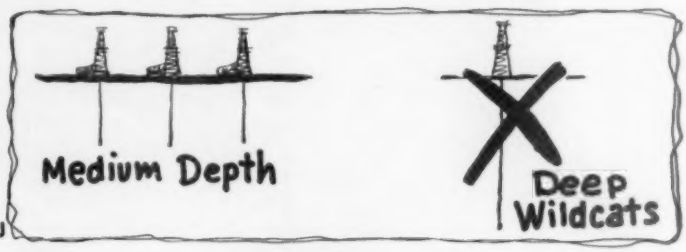
1 . . Good well in a stripper pool makes allowable for entire unallocated lease. The same well in allocated area would get far less.





2. . Unallocated-pool production is taking over half the Oklahoma market. Result: Payout longer on new wells, drilling discouraged.

3. . . Deep wildcatting for new reserves doesn't pay under the present system. Capital for this play going to other states.



They all add up to explain why . . .

Proration is Key to Oklahoma Problem

FAILURE to achieve generally good conservation of oil and gas in Oklahoma, as reported by a large number of operators, can be laid to the state's proration system.

Proration is a method of dividing the state's crude-oil market among fields and wells. And in Oklahoma there has been a running controversy over this division for several years.

This controversy often looks like little more than a competitive struggle for markets between producers and purchasers, or between majors and independents, or between different areas of the state.

This marketing competition has obscured what many producers say is a serious weakness in the proration system—its failure to promote conservation.

This need not be so, according to conservation authorities. Some states without any market-demand proration have better conservation practices than Oklahoma has. And states with different proration systems have found it possible to achieve conservation regardless of the inevitable arguments over division of the market.

What's Wrong?

The root of Oklahoma's trouble is that more than half its production comes from so-called unallocated pools.

The Corporation Commission exercises almost no control over production practices in these unallocated areas. This has resulted in:

. . . **Inability** to keep the state's total production in line with the commission's estimate of over-all allowables.

. . . **Inequitable** allowables, both as between allocated and unallocated pools and among individual producers in unallocated areas.

. . . **Failure** to get uniform application of good production and conservation practices in the unallocated fields.

Every oil field in Oklahoma is classified as either allocated or unallocated. The allocated fields have their allowables adjusted each month in accordance with the commission's estimate of demand for crude. The unallocated fields normally are allowed a flat maximum of 25 bbl. per well per day—if they are capable of making it—averaged on a lease basis. (In some recent months, it has been necessary to reduce the unallocated below 25 bbl.)

Reasons why . . . The original reason for this classification is agreed to be simple and sound. Most states with proration use a similar device, to some extent.

An unallocated pool is supposed to be a stripper field with settled production — an old, nearly depleted field, whose wells will make only a few barrels per day.

The presumption is that these old wells cannot be curtailed without causing underground waste, premature abandonment, and irreparable loss of oil in the ground.

It is recognized as good conservation to permit stripper wells to produce to the limit of their capacity. They should get first call on the mar-

ket while curtailing flush production when necessary to adjust over-all output to total market demand.

What happened . . . But, say dozens of Oklahoma operators, it is not good conservation the way it operates in this state. Critics make these points:

. . . A 25-bbl. well is too big to be considered a stripper; the definition should be tightened and the limit lowered.

. . . The lease basis for allowables permits some very big wells—including some flush production—to be averaged against actual strippers.

. . . Unallocated areas include so much of the state's production that the commission is unable to keep total output within the level of market demand.

. . . Deep drilling is discouraged because the allowables given the allocated areas are too low in comparison with those for shallow wells.

. . . Switching of pools from one category to the other has sometimes been permitted for little reason other than to give producers bigger allowables.

. . . Lax policing of the unallocated areas has permitted some operators to produce more than they are entitled to even under the state's liberal rules.

New Yardstick

In August 1954 a new "yardstick" was applied to allocated pools by Massena B. Murray, director of conservation.

This was hailed as a big forward step, an effort to put allowables on a more equitable basis.

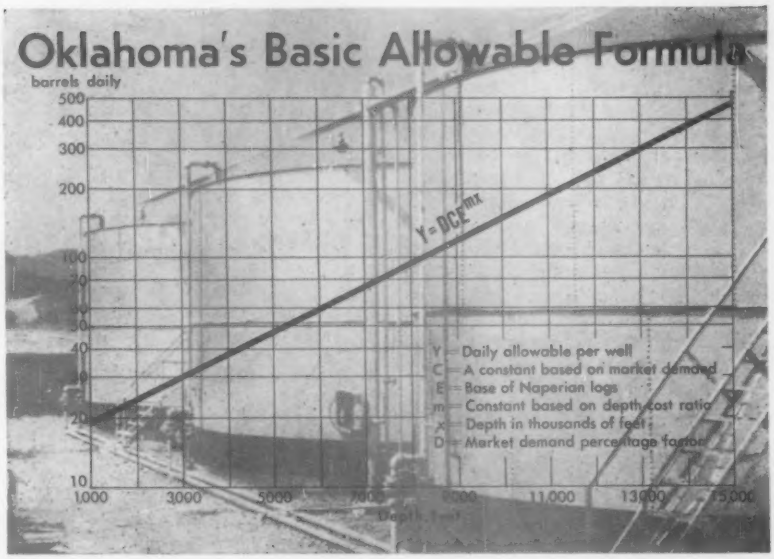
This yardstick employs a mathematical formula and a "log-log curve" to give recognition to such factors as depth, cost, acreage, and producibility *(see illustration)*.

Operators in the allocated pools are more or less satisfied with this approach, but are not at all satisfied with the results.

In practice, Director Murray has to estimate the ensuing month's production from unallocated areas, subtract this from his estimate of total demand, and apply the yardstick to the remainder.

This line has never coincided with the theoretical "100 per cent line" originally drawn on the chart. During the past 18 months, allocated wells have had allowables ranging from a low of 39 to a high of 65 per cent of what the chart line indicates.

One result is that some allocated wells have had allowables no higher than unallocated wells. Operators say that the system should be revised so that high-cost (allocated) wells will get allowables sufficient to give them a decent payout comparable to that of the low-cost (unallocated) wells.



OKLAHOMA'S DEEP WELLS get an allowable based on this chart. Individual well allowables deviate from the theoretical figure on the chart because of adjustments for such factors as spacing, productivity, and gas-oil ratio. Monthly allowables are set as a percentage of the figures derived from the straight line on this chart.

Here's the squeeze . . . To show how the allocated pools get the squeeze when market demand slumps, operators cite some figures.

In October 1955, pipeline runs of Oklahoma crude totaled 550,641 bbl. per day. Of this, 295,122 bbl. per day or 53.6 per cent, came from unallocated and 255,519 from allocated pools.

In October 1956, with demand up a bit, runs totaled 560,000 bbl. daily. Of this 308,000 or 55.0 per cent, came from unallocated and 252,000 from allocated.

Allocated areas include about 570 pools with more than 11,850 wells.

Unallotted areas embrace approximately 770 fields. The commission doesn't know exactly how many wells are in these fields, but industry estimates range from 48,000 to 63,000.

The state has 360 water-flood projects with 12,901 producing oil wells and with a current production of about 85,530 bbl. per day. All but 11 of these projects are classified as unallocated.

Check on water floods . . . As in other states, there is a standing argument in Oklahoma whether water-flood production should be subject to proration.

But some producers say that some water-flood operators are taking advantage of their position to produce more than their share of the state's allowables.

For example, one engineer told of this situation—which he said was not an isolated instance:

"The operator of a water flood drilled a well at the edge of his project but went down to a deeper pay zone—a zone not under flood. He included the new well in the unit and thus got the benefit of unlimited allowables, so he produced it to capacity. But just across the lease line an offset well in this deeper zone was limited to 25 bbl. per day. This is unfair drainage and a violation of correlative rights."

Within the last couple of months Director Murray has started a survey of water floods, and this study could lead to some revision of the rules.

Crux of Fight

The bitterest indictment made against Oklahoma's proration system is the use of lease allowables in the unallocated areas.

This means that a producer can average all his wells on a single lease and produce a total equal to the number of wells times the maximum for that month (usually 25 bbl. per day).

Here again there is a historic and economic justification for the practice. It was designed for very small wells, to relieve the operator from installing separate gage tanks and making individual well reports.

But scores of operators point to serious abuses. There's a sampling of what the canvass revealed:

. . . One good well is enough. If a lease has 10 wells, its allowable is (normally) 250 bbl. per day. Say 9 of these can't produce more than 10 or 20 bbl. per day at capacity. But one good well on the lease can be produced

wide open to bring total lease output to 250 bbl. This may shorten the good well's life, injure the reservoir, and drain offset leases.

. . . Dead wells remain on the books. A well that has sanded up or gone entirely to salt water can be counted as a producer, and the entire lease allowable produced from one or two good wells.

. . . Dry holes pay off. One story is told of an operator in eastern Oklahoma who brought in a good producer and then drilled four dry holes offsetting it. He put pump jacks on all five wells, assigned all five allowables to the one well, and let it produce the entire pool in 3½ years.

. . . New pays are included. Under a strict interpretation of the rules a lease allowable applies to a single producing zone only. But in some unallocated areas producers have found new pays at deeper zones. They have produced these wells heavily, throwing the production in with the old, shallow production to maintain the per-well average.

Here's an incident that illustrates the last point:

One operator had four wells producing from shallow sands in an unalloted area for 15 years. All were playing out, making far less than their allowable. He drilled to a deeper sand and got a good well. Then his lease had five allowables and he could produce the entire 125 bbl. per day from the deeper sand if he wanted to.

But the owner of the offset lease had no shallow production. He brought in a producer in the deeper pay, but he was limited to 25 bbl. per day. But the well just one location away was draining him by producing five times as much.

A different twist to the story is told by another operator:

"We were interested in unitizing an unallocated area in southern Oklahoma but ran into some objection. We soon found out why. Some of the operators there were counting salt-water disposal wells and dry holes in the number of wells on their leases, and assigning a 25-bbl. allowable to each. They were producing more oil under that method than they could hope to under a water flood."

No lease reports . . . Opportunities for producing more oil than contemplated by the allowables arise from the poor statistical control exercised by the Corporation Commission.

It is a fact that Oklahoma is the only important producing state that does not require producers to file a monthly report showing the status of each lease, its producing ability, and its actual production.

Next Week . . .

What's the Answer?

The third and final article in The Oil and Gas Journal's series on Oklahoma's conservation problems will appear in the January 14 issue.

It will deal with administrative procedures of the Oklahoma Corporation Commission and outline what oil men in the state believe should be done to improve conservation practices.

In Texas, for example, these reports (known there as E.B. reports) are an important tool in keeping production equitable as among leases and in keeping total production in line with statewide allowables. They can be checked against pipeline companies' reports on volume of oil run from each lease during the month.

The Oklahoma commission has producers file monthly reports directly with the pipelines. The pipeline takes the producer's word as to his allowable. The pipeline gager may suspect that a certain producer has overstated his proper allowable, but he has no authority or responsibility to go back of the lease tank.

Pipelines and oil purchasers are uneasy about this. They have a legal responsibility, under both state and federal laws, to run no more crude from any lease than is called for by the allowables. Yet they have no power nor desire to police actual production. They feel that it is the commission's duty, rather than theirs, to see that production does not exceed allowables.

Morally wrong? . . . Such instances show why the lease-allowable system is criticized by many operators—particularly those whose interest is chiefly in the deeper, allocated areas.

They also show why crude-oil purchasers complain that the system makes it almost impossible for the Corporation Commission to control the state's total production—or even to estimate what production would result from a change in the maximum allowable for unallocated pools.

But they are not the only ones dissatisfied. Here is a typical reaction, expressed by a substantial independent producer:

"We're not hurting by proration on a lease basis.

"But lease proration is morally wrong. It's bad for the state and bad for the industry. It results in inequities and injury to correlative rights. It causes waste of oil, prevents proper reservoir control, and cuts down maximum ultimate recovery.

"If per-well allowables were substituted for lease allowables, our production would be cut way down. But everybody else would be in the same boat until we got readjusted.

"We would then have an incentive to clean out our poor wells and hold in those that are producing more than their fair share. We would develop our properties properly, and we'd all recover more oil in the long run.

"We want our little company to be in business long after my associates and I are dead and gone. But that won't happen unless we get better conservation here. Some day Oklahoma is going to wake up and wonder what happened to its oil industry."

Deeper in the hole . . . Allocated pools are "nailed to the barn door" on allowables, in the words of one producer. Operators in the allocated areas have two main complaints:

. . . Deep wells are assigned so small a portion of the state's total production that their payout period is much longer than that of shallow wells.

. . . Close check is made in many allocated areas with the result that indivdual wells have their allowables reduced following potential or gas-oil ratio tests. Similar penalties are not applied in unallocated areas.

Oil men admit that unallocated pools sometimes have been curtailed in order to take a portion of the reduction in market demand for Oklahoma crude. But they claim that permitting these allowables to be applied on a lease basis makes them meaningless when compared with the per-well allowables in allocated pools.

Oil men interested in developing new reserves are most vociferous against the system. They warn that the present allowables pattern is threatening Oklahoma's future as an oil state, and say:

. . . New reserves in the state, according to geologists, lie in the deeper sands.

. . . Cost of wells in the range of 7,500 to 12,500 ft. or deeper represents a sizable investment.

. . . Payout of deep wells under pinched allowables is too long. The same exploration investment in other states brings a quicker return.

The result is discouragement of deep drilling, with possible new reserves going untapped until the economic climate changes.

More than one substantial operator says that his drilling budget is being assigned to states which have a more forward-looking conservation policy than Oklahoma.

Humble Breaks 3-Year-Old Crude Price

● Unable to meet its demand, company jumps prices by 25 to 45 cents a barrel; it's the first major change since the 50-cent hike on June 15, 1953.

HOUSTON.—An increase in crude-oil prices averaging 35 cents per barrel was posted in Texas by Humble Oil & Refining Co., effective 7 a.m. January 3.

Continental Oil Co. was the first to follow Humble's lead, spreading the advance into Southeast New Mexico. Continental's increase ranged from 35 to 40 cents a barrel.

Executives of other large crude-buying companies went into huddles Thursday afternoon immediately after hearing the news. The industry was prepared for a series of announcements from other companies over the weekend.

While the time and source of the price increase caught most buyers by surprise, it was an open secret that a number of big companies had been anticipating such an action for some weeks.

Hines Baker, Humble president, said: "The immediate cause of this price change is the sharp increase in demand for domestic crude oil, particularly in Texas, that has developed since the flow of Middle East crude oil to Europe and the East Coast was drastically curtailed by recent events.

"Humble has been unable to secure its requirements at former prices."

Baker also explained that an important and more basic cause for this action was increased costs since the last general increase in June 1953. He pointed out that the increase should help secure the additional supplies needed, and on a long-term basis help find additional domestic reserves.

More crude will flow . . . The judgment that the higher price will bring out greater supplies of crude was confirmed by others. More oil is available at the right price, they say. Independents, by and large, have been holding back on increased production. They do not care to sell their oil to Europe at prices about equal to the cost of replacing it with new oil.

The price increase may bring down crude stocks faster, particularly inland stocks that can be moved to tidewater. For example, there have been reports that owners of substantial crude stocks in the Mid-Continent refused to sell them in December even though purchasers had transportation available.

There was some surprise that the first price increase came from Humble, which normally produces more crude than it refines. The general expectation was that the upward movement would be initiated by a major refiner which normally buys a large share of its crude from others. Such a company, if having difficulty covering its crude requirements, might be expected to offer a higher price to attract greater supplies.

Humble, however, is acting as the chief crude-procurement agency in Texas for Esso Standard Oil Co. (which has huge refineries but negligible production) and also for Esso Export Corp. which supplies U. S. oil to European affiliates of Standard Oil Co. (N. J.).

Some reasons . . . Humble's predicament was explained in some detail at the state-wide allowable hearing of the Texas Railroad Commission December 19.

Humble nominated 18 days' production in Texas for January, but the commission subsequently set the allowables at 16 days, the same as the December level. The 18 days would have increased Texas' output by about 300,000 bbl. per day. However, at the hearing Humble said it could provide a market for 100,000 bbl. per day above its share of that.

A Humble representative made an open offer to purchase all spot crude that can be delivered to seaboard up to 170,000 bbl. per day, in addition to handling 18 days' production from all of its Texas connections.

For Esso Export, Humble tried to buy 300,000 bbl. per day during December, and tankers were available to lift it, but it could make spot purchases totaling only 165,000 bbl. per day. As a result, some tankers were diverted to the Persian Gulf because U. S. crude was not available to load them.

Humble representatives at that hearing said that they had tried to buy 10,000 bbl. per day in Oklahoma for Esso Export, and had arranged pipeline space to move it to tidewater, but they could succeed in purchasing only 2,000 bbl. per day. From this they argued that holders of Mid-Continent stocks were unwilling to part with their crude.

Humble also used this as an argument for increasing production in West Texas and New Mexico and moving the crude by pipelines through Oklahoma to the Mississippi River to be barged to the gulf. These pipelines have the only substantial unused capacity out of the Permian basin region.

Humble said that its own stocks were down to about 16,000,000 bbl. by mid-December. It said this is the minimum working level in view of its normal handling of close to 625,000 bbl. per day. Close to 3,000,000 bbl. is pipeline fill.

Humble's Increases

Up $0.45 a barrel:

Texas Gulf Coast (Low Cold Test) —except Goose Creek $0.35.

Mixed Sweet Crude—Hastings, etc., except Lovells Lake $0.32.

Mixed Sweet Crude—Upper Gulf Coast.

Refugio Light Crude.

Refugio Heavy Crude.

Mirando Crude.

Up $0.40 a barrel:

Sweden Crude—Borregos, Cayo Del Oso, etc., except Palo Blanco South Fault Block $0.27.

Sweden Crude—Cox & Hammond and Long Mott East Crude.

Crude from Candelaria, Charlotte, etc.

Crude from Charlotte North, Horn (5,300 ft.), and Horn (Austin Chalk).

Up $0.35 a barrel:

Crude from Hawkins, Hitts Lake (Paluxy), etc., except Pewitt Ranch $2.11 flat price, up $0.10.

Up $0.30 a barrel:

Sweden Crude from Armstrong, Colorado, etc.

Up $0.25 a barrel:

Crude from Pearsall (Austin Chalk) and Pearsall (Navarro).

East Central Texas Crude.

Panhandle Crude.

West Central Texas Crude.

West Texas Crude.

The following are flat price crudes with new prices and amounts of increases:

Conroe, Tomball West (Adams) and (Treseler), up $0.49 to $3.53.

Conroe Townsite (Cockfield) and Conroe Townsite (first and second Upper Cockfield), up $0.40 to $3.42.

Darst Creek, Hilbig, Lenz, and Salt Flat, up $0.25 to $3.04.

East Texas field, up $0.35 to $3.25.

Mt. Sylvan and Van, up $0.40 to $3.13.

Neches (sub-Clarksville), up $0.35 to $2.80.

Refiners Handed New Up-grading Tool

● Flexibility and short pay out big advantages for Kellogg's process

NEW YORK.—Refiners facing the need of upgrading their high-octane gasoline pool last week were offered another process as a possible solution.

The M. W. Kellogg Co. of New York introduced its "Iso-Kel" process. It is designed to convert normal or straight-chain pentane and hexane to their higher octane branched-chain isomers.

This new isomerization process will upgrade a variety of feed stocks. It can handle:

. . . Pentanes or hexanes or both.

. . . Wider-boiling natural gasolines.

This flexibility in one process offers refiners marked economic advantages, Kellogg said. This is even more apparent in another facet of the process: Two separate product streams can be made from a single mixed feed stock.

These streams are:

. . . Isopentane for the refiner's premium or superpremium grade. This is available with a CFRR rating of 104.9 with 3 cc. of TEL.

. . . Four branched-chain isomers of hexane. Depending on the type of feed, they show a CFRR rating of from 89 to 92 with 3 cc. of TEL. This octane is not high enough to permit much blending to higher than regular-grade gasoline. But it still represents an octane gain of from 24 to 27 research-octane numbers over leaded normal hexane.

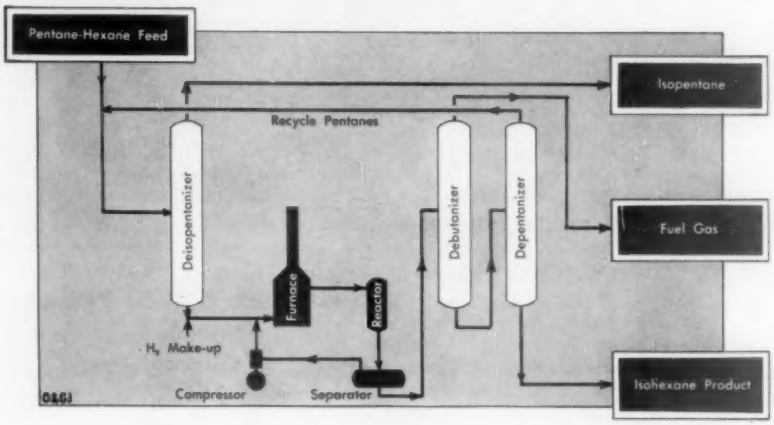
From a light naphtha charge, Kellogg reported a 97 per cent volume yield of combined streams of about 96 CFRR plus 3 cc. of TEL. Natural-gasoline feed stock gives better results—an over-all yield of 99 per cent with a leaded research-octane rating of about 99.8.

New catalyst . . . Iso-Kel uses a new precious-metal catalyst. Kellogg officials say this is the secret of its advantages.

Exactly which noble metal Kellogg is using was not revealed. But this much is known: It is not platinum.

The process employs a single fixed-bed reactor. Vaporized feed is passed through the catalyst bed together with recycled hydrogen. No corrosive elements are present in the system. Operating conditions are less severe than those required for catalytic reforming of heavy naphthas.

Here's How New Iso-Kel Works . . .



. . . And What Process Means to Refiners

A RELATIVELY short payout time is claimed for the new Iso-Kel process. Kellogg economists illustrated this feature by compiling figures on a hypothetical 3,100-bbl. per day commercial Iso-Kel unit. It would be incorporated in a 50,000-bbl. per day refinery.

The chart below shows expected yield and product inspection for three types of feed stock obtained from experimental runs on pentanes and hexanes.

Payout for an isomerization unit of this size would be about 19 months. In cases where existing fractionation or other facilities could be used, the payout would be shorter.

	Kuwait		Mid-Continent		Natural gasoline	
	Feed	Product	Feed	Product	Feed	Product
Total C_5-C_6 volume per cent	100.0	97.3	100.0	96.7	100.0	99.2
Octane CFRR-clear	63.7	77.7	62.1	77.0	72.3	83.3
+ 3 cc. TEL	88.3	96.2	87.3	95.8	93.9	99.8
PENTANE FRACTION:						
Volume per cent of total C_5-C_6	45.0	45.0	34.5	34.5	58.5	58.5
Octane CFRR-clear	74.4	91.0	72.9	91.0	79.2	91.0
+ 3 cc. TEL	95.8	104.9	94.9	104.9	98.4	104.9
HEXANE FRACTION:						
Volume per cent of total C_5-C_6	55.0	52.3	65.5	62.2	41.5	40.7
Octane CFRR-clear	54.9	66.3	56.4	69.2	62.2	72.2
+ 3 cc. TEL	82.2	88.7	83.3	90.7	87.5	92.4

How it works . . . The new process can be adapted to varying conditions and desired results.

For instance, the refiner may:

. . . Prefractionate feed to recover the higher-octane isomers before charging the components rich in normal paraffins to the reactor.

. . . Separate unconverted normal paraffins from the reactor effluent for recycle.

. . . Recycle normal pentane and process hexanes on a once-through basis. Kellogg found the best over-all economic returns resulted from this method.

Such a process is outlined in the accompanying flow chart. A mixed pen-

tane-hexane feed stock containing both branched-chain and normal isomers is joined by a recycle stream of mixed isomerization-pentane product. Both virgin and converted isopentane is recovered as high-octane blending stock in the deisopentanizer.

Normal pentane and mixed hexanes are then heated together with hydrogen-rich gas. Then they are charged directly to the single reactor. Hydrogen-rich gas from the effluent separator is recompressed for recycle. The mixed-reaction product is stripped of butanes and lighter. It then passes to a depentanizer column which recycles total pentanes overhead. The resulting stream is an isohexane-rich product.

This system permits a once-through isomerization of hexanes with only a small added cost over pentane isomerization alone. For a further increment in capital and operating costs, greater upgrading is possible through the complete recycle of normal hexane. This would require a deisohexanizer column and an auxiliary depentanizer to remove hexanes from the combined feed and reactor-product streams.

Why higher octanes? . . . Isomerization will not provide the over-all boost to pool octane that has resulted from catalytic reforming.

It applies to a smaller gasoline content and does not result in the mass of high-octane product.

But isomerization offers an important added increment to total pool gasoline octane. It converts some very low-quality hydrocarbons to octane levels which equal or exceed those of today's house-brand and premium fuels.

The following ratings on straight-chain and branched-chain pentanes and hexanes explain how isomerization will provide this added step toward higher pool octanes:

	Research octane number	
	Clear	+3 cc. TEL
n-Pentane	61.7	88.7
i-Pentane	92.3	105.7
n-Hexane	24.8	65.3
2 methylpentane	73.4	93.1
3 methylpentane	74.5	93.4
2,2 dimethylbutane	91.8	104.3
2,3 dimethylbutane	102.7	108.9

The 100-plus octane ratings shown in this table refer to extensions of the Research scale (ON=128−2,800/PN). The Wiese scale above 100, which will be formally adopted this summer, shows higher ratings for these isomers. This scale [ON=100−(PN−100)/3] gives isopentane a rating of about 108.5 octanes. The two isomers of hexane—2,2 dimethylbutane and 2,3 dimethylbutane—have octane ratings on the new scale of about 106.0 and 115.5 respectively.

What's ahead . . . When refiners have realized more of their potential octane from existing catalytic reformers, they can resort to isomerization.

A consensus seems to indicate that when reforming severity has risen to a point where yields drop to about 80 per cent, isomerization will come into commercial usage.

That day may not be far off.

Meanwhile, refiners have Kellogg's new process together with several others to study before contracting for this next round of investment in quality improvement of gasoline.

In California tidelands . . .

. . . Wildcat-Lease Prices Zoom

LOS ANGELES. — An indication of the value oil men place on California's undeveloped tidelands came last week. The State Lands Commission provided the test in offering a 5,500-acre lease offshore from Summerland, Santa Barbara County.

High bidders on the parcel were Standard Oil Co. of California and Humble Oil & Refining Co. They submitted a joint cash-bonus offering of $7,250,606. This is the highest bid ever received for a California offshore tract and approaches some of the top bids for Gulf Coast offshore leases.

Tidewater Oil Co. only last June 26 successfully bid on a 500-acre parcel between the old Summerland oil field and the Standard - Humble acreage. Tidewater's lease went for $75,000. It was classified as on a known producing structure calling for a sliding 16⅔ per cent royalty scale.

The acreage bid on by Standard-Humble was labeled wildcat territory with a flat 12½ per cent royalty.

The commission will rule January 10 on the Standard-Humble bid.

This first offering of a significant portion of the state's tidelands under provisions of the Cunningham-Shell Act also attracted two other bidders. The Texas Co., Monterey Oil Co., and Newmont Oil Co. made a joint cash bonus bid of $5,667,777. The C.U.S.S. group (Continental, Union, Shell, Superior) offered only $655,310 for the parcel.

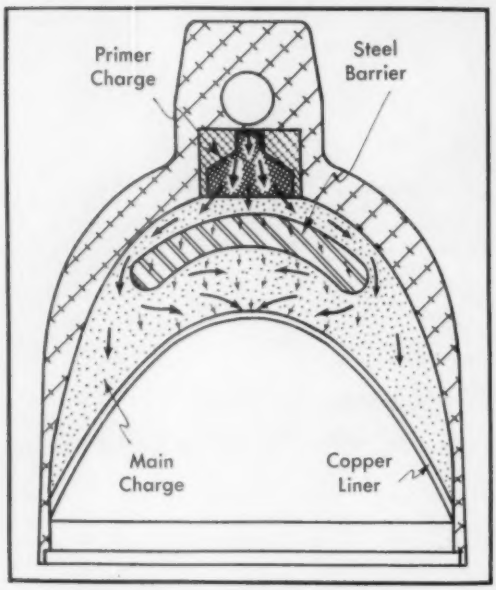
Gulf, Humble Hit Offshore

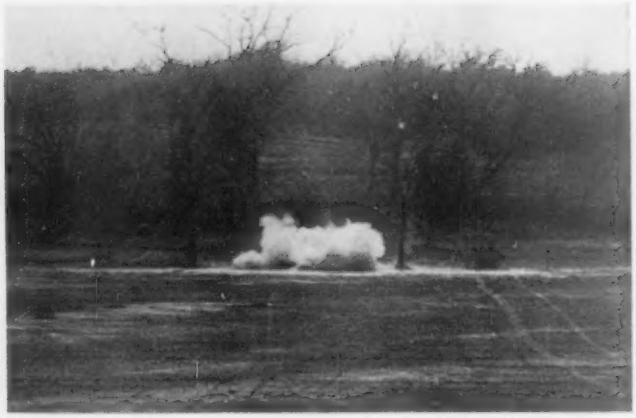
NEW ORLEANS.—Gulf Oil Corp. and Humble Oil & Refining Co. have discovered oil on a big block of submerged leases 29 miles offshore from Lafourche Parish, Louisiana.

The discovery, Gulf-Humble A-4, flowed at the daily rate of 346 bbl. of 30.9°-gravity oil with no water from perforations at 10,770-85 ft. Test was through 10/64-in. choke.

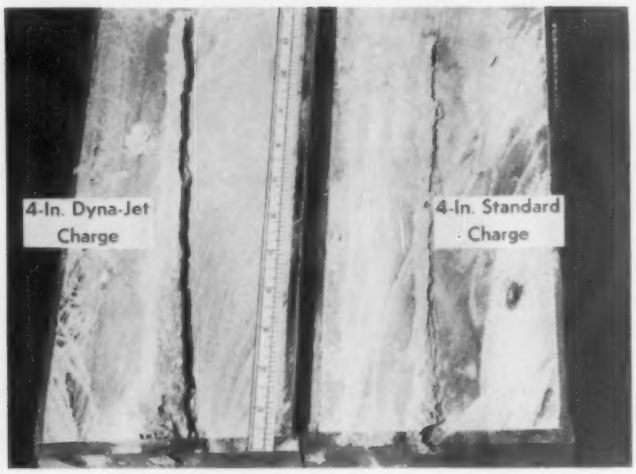
Located in 103 ft. of water, the test is in Block 135, South Timbalier area. The zone tested has 31 ft. of oil sand. Tubing pressure was 1,725 psi. and gas-oil ratio was 640:1.

This new charge looks ordinary above ground . . .





. . . But it opens a hole four times larger below



Jet Perforator Given a New Wallop

ARLINGTON, Tex.—A new shaped charge began punching holes in pay formations over much of the oil country last week. It is radically different and much more effective.

The new jet-perforating weapon was officially unveiled January 1 by Jet Research Center, Inc., a subsidiary of Welex Jet Services, Inc., and Byron Jackson Co. But orders for the charge had been placed previously. It went to 18 domestic and 15 foreign oil-well servicing firms licensed to use the fruit of Jet Research Center's labors.

Reasons for this sudden popularity are fairly obvious. Heavy test firing of the new charge from a 4-in. perforating gun have proved that it averages:

. . . 111 per cent more hole area than the present standard 4-in. charge.

. . . 205 per cent more hole volume.

. . . 16.8 per cent deeper penetration.

The charge achieves this using the same type and amount of explosive as in the older standard charge of the same size.

R. L. Robinson, Jet Research's manager of research and technical director, thinks that the missile will displace older standard 4-in. charges within the year. It would take over even sooner, he feels, except that companies having large numbers of older charges in stock may use them up before ordering the new type.

New design the key . . . The new charge, named the Dyna-Jet, gets its tremendous power primarily from two drastic departures from conventional charge design. The changes are:

. . . A new ellipsoid shape. Jet Research junked the old cone-shaped liner.

. . . A steel barrier in the explosive charge. This barrier was added over the apex of the liner. When the charge is triggered, the barrier slows up shock waves traveling through it and initiates a low-order detonation in the main charge on the other side.

Meanwhile, unimpeded high-speed shock waves travel out around the barrier and overrun the expanding low-order front. In the low-order zone only part of the explosive has reacted. That not reacted, however, has been subjected to high temperature and pressure. These increase its detonation rate and pressure.

It is this overrunning action of the low-order by the high-order detonation in the spherical portion of the liner which contributes the big power increase.

Larger hole . . . The resulting jet, along with its spectacular results in hole area, volume, and penetration,

bores an entrance hole four times larger than the standard model.

Also, the shape of the new copper liner either eliminates the "carrot" or plug of liner metal. This was found early last year to be sealing perforations newly opened by several types of conventional charges.

The new shaped charge is the result of several years of research work by Jet Research, its parent firms, and Poulter Laboratories of Standard Research Institute. Work by Poulter was sponsored by Welex Jet and Byron Jackson.

The research effort was channeled primarily at developing a charge which would make a much-bigger rather than a much-deeper hole.

Blackfoot Decision

Firm will learn this month if development deal legal

WASHINGTON. — Interior Department officials will rule this month on the legality of a proposed arrangement to turn the Blackfoot tribal lands over to an oil company for development.

No formal proposal has been submitted, but the department has been asked whether the outlined deal would meet its tests.

The plan, reportedly, is to turn about a million acres of Blackfoot lands over to a company which would explore and offer potential oil-bearing areas for competitive leasing.

The leases would meet department regulations, but royalty terms might be higher than those demanded by the Government. Exploration and other costs would be taken out of receipts and the remainder divided between the company and the tribe.

Navajo deal . . . Indian Bureau officials also are trying to work out an arrangement with the Navajo Indians which would clear the way for oil development on more than 5 million acres of their lands.

A 25-year lease offered by Delhi-Taylor Oil Corp. was turned down by the department last year because it was arranged without competitive bidding required by law.

Officials said the two situations are different. The Blackfoot Tribal Council has authority to do business and the main point to be decided by the Government is whether the plan would be a legal delegation of the council's authority. The Navajos do not have as broad authority and the Interior Department supervises its business operations.

Pipeline briefs

Sinclair Pipe Line Co. last week became the sole owner of the Silsbee-Hull crude systems, which gather 20,000 bbl. per day for delivery to Sinclair and other lines to the Houston, Beaumont, and Port Arthur areas. Sinclair purchased half interest in Silsbee and one-third interest in the Hull system from American Petroleum Co. in 1955 and the remainder from Atlantic Pipe Line Co. last year.

The systems include 93 miles of 2 to 10-in. gathering lines and 56 miles of 6 and 8-in. trunk lines.

Sinclair Pipe Line also has acquired 20 per cent undivided interest in South Saskatchewan Pipe Line Co. and 40 per cent interest in Minnesota Pipe Line Co. These interests were acquired through Sinclair Oil & Gas Co.'s purchase of Southern Production Co. South Saskatchewan has a 225-mile 12 and 16-in. line and Minnesota has 256 miles of 16-in.

Price-Poole Pipeline Constructors of Canada, a joint venture of H. C. Price of Canada, Ltd., and Poole Construction Co., Ltd., plans to start laying pipe in early spring on its 99-mile spread in Manitoba for Trans-Canada Pipe Lines, Ltd. Right-of-way has been cleared on this section of the line. Double jointing crews will start work during the winter in advance of full-scale construction.

Rich Construction Co. has received the contract to lay 18 miles of 16-in. natural-gas line for Equitable Gas Co. between Penn Township to Salem Township in Pennsylvania. The project is to be completed February 1.

Cities Service Gas Co. will drill 55 injection and withdrawal wells in the McLouth storage field in Leavenworth and Jefferson counties, Kansas. The program is part of $4,200,000 in construction approved by the Federal Power Commission in Kansas, Missouri, and Oklahoma.

Cities Service also will install 6,750-hp. at compressor stations in Leavenworth and Anderson counties, Kansas; Cass County, Missouri; and Oklahoma County, Oklahoma, plus 64 miles of 6 to 30-in. gas lines. The expansion will increase deliverability from storage and between storage and markets.

Natural Gas Storage Co. of Illinois plans to develop an underground storage project in a 5,000-acre porous sandstone reservoir on the Coles-Douglas county border in Illinois. The Federal Power Commission will be asked to approve the project, estimated to cost $4 million. Capacity has not been disclosed.

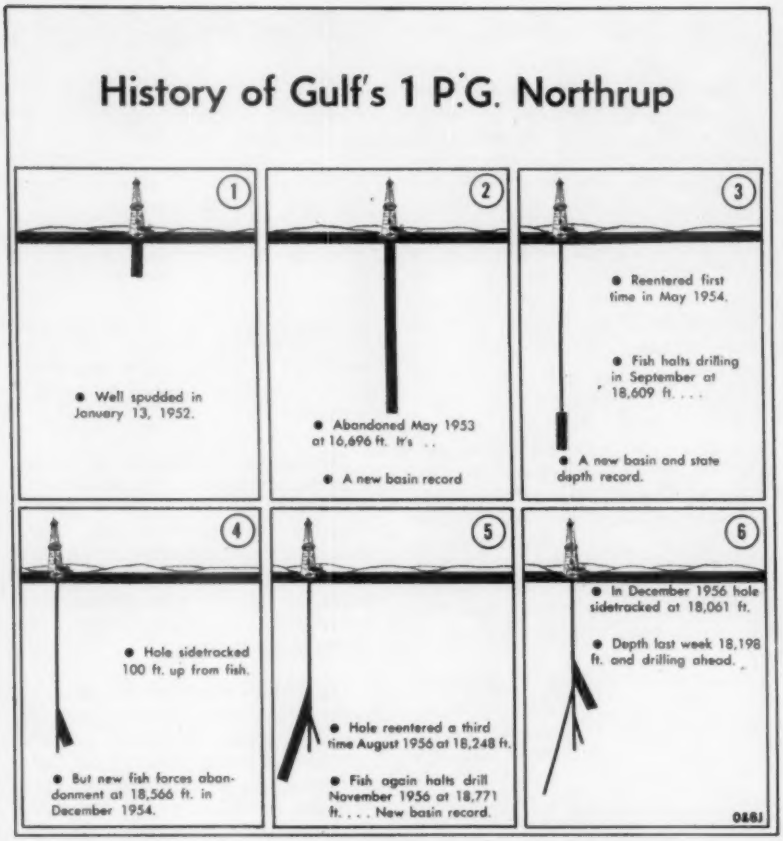
United Gas Pipe Line Co. has contracted 48.47 miles of 20-in. in Louisiana to Brown & Root, Inc. The gas line is being laid from Deep Lake field to the Lake Charles area. Williams Brothers Co. has completed 5.5 miles of 20-in. in the same area. Two other United Gas Pipe Line jobs just finished are 15.5 miles of 20-in. from Chocolate Bayou field to the Houston area and 12.7 miles of 10-in. from Lake Pasture and Mary Ellen O'Connor fields to the company's 30-in. system.

Oklahoma Mississippi River Products Line., Inc., has completed a 22-mile, 6-in. products line from Conway, Ark., to Little Rock Air Force Base. Contractor was O. R. Burden Construction Corp.

Also for Pipeliners . . .

Aluminum pipe is making another bid for wider use in the oil industry (P. 82) . . . An industry committee has concluded the domestic industry has the producing power to meet an emergency, but lacks transportation facilities. A committee report supports the idea of a pipeline from the Midwest to the East Coast (P. 82) . . . Plantation Pipe Line completed its 1956 looping program just under the contract deadline (P. 89) . . . The FPC has approved a Texas-to-Florida natural-gas pipeline system, but attached some stiff requirements the applicants must meet . . . Interprovincial lets contracts for looping program . . . Phillips has completed a loop on its Borger to St. Louis products line (P. 90) . . . Israel reports construction is moving along on its crude line from the Gulf of Aqaba to Haifa. Reports are still circulating that a leg will be built to a southern Israeli port for movement of crude to Western Europe (P. 96).

PLUS THESE TECHNICAL FEATURES: Petrochemical pipelines may come to the Midwest and, with them, plants that otherwise would land on the Gulf Coast. An economic study shows what would be involved (P. 106) . . . and Pipeline Patrol's construction tables (P. 140).


History of Gulf's 1 P.G. Northrup
1
• Well spudded in January 13, 1952.
2
• Abandoned May 1953 at 16,696 ft. It's . .
• A new basin record
3
• Reentered first time in May 1954.
• Fish halts drilling in September at 18,609 ft. . . .
• A new basin and state depth record.
4
• Hole sidetracked 100 ft. up from fish.
• But new fish forces abandonment at 18,566 ft. in December 1954.
5
• Hole reentered a third time August 1956 at 18,248 ft.
• Fish again halts drill November 1956 at 18,771 ft. . . . New basin record.
6
• In December 1956 hole sidetracked at 18,061 ft.
• Depth last week 18,198 ft. and drilling ahead.
OGJ

Tough Luck Dogs Wildcat

Gulf has poured plenty of cash over 5 years in Delaware basin deep test; so far its only return is frustration

PECOS, Tex.—Gulf Oil Corp.'s 1 P. G. Northrup 24 miles southeast of here holds the dubious honor of being probably the world's toughest and orneriest hole in the ground. It is also one of the most costly.

And to Gulf should go some sort of award for persistence.

Gulf has been drilling this hole, off and on, since January 13, 1952. In that time the operator has . . .

. . . **Abandoned the well** temporarily and then reentered it three times.

. . . **Sidetracked the hole** three times due to impossible fishing jobs.

. . . **Kept a heavy-duty rig** on the project, all told, about 840 days, roughly 2⅓ years.

The 1 Northrup currently holds the drilling depth record for the Permian basin area of 18,771 ft. It held this record twice before at lesser depths during its 5-year career.

At one time it was the deepest hole in the state. This was in August 1954 when it reached 18,609 ft. The well will again take over this title if Gulf ever can manage to push the hole down to its target depth of 19,200 ft.

Gulf declines to say how much money has gone down this deep hole. But drilling-engineer experts say the well so far is sure to have cost over $1,000,000 and very likely more than $2,000,000.

It's reported reliably that Gulf allocated $325,000 when it entered the hole the last time last August just to take the well on down from 18,248 to 19,200 ft. This last chunk of budget reportedly has been pretty well chewed up, if not entirely devoured.

Series of frustrations . . . The story of the 1 Northrup, and those of other similar frustrating holes, could make a telling argument in favor of the depletion allowance if that vital provision should be attacked in Congress again this year.

Gulf moved on the remote Reeves County, West Texas, location and spudded in January 13, 1952. The location geologically is in the southeastern portion of the Delaware basin. The acreage was turned over to Gulf by Jack Frost, Dallas, for a small overriding interest in production.

Sixteen months later Gulf, battling severe lost-circulation troubles, had fought the hole down to 16,696 ft., a drilling-depth record for the Permian basin area. It moved off the hole in May 1953.

A year later, in May 1954, the company reentered the hole. It soon recaptured the basin drilling mark which had fallen to a Richardson & Bass hole in Eddy County, New Mexico.

In August, the hole passed 17,966 ft., snapping the state depth record then held by Superior Oil Co.'s 27 Minnie S. Welder in San Patricio County. The mark was extended to 18,609 ft. by September, then trouble came again.

Two packers stuck in the hole during an attempted drill-stem test at 18,609 ft. All efforts to pull, washover, grind out, or otherwise remove the plugs failed. Washover pipe was lost in the hole at one time but was recovered.

Gulf gave up trying to clear the plugs in November and backed up 100 ft. to whipstock the hole. This effort came to naught in December when drill-pipe twisted off near bottom when the sidetracked hole had reached 18,566 ft. Efforts to clear the hole again proved fruitless. The hole was abandoned the second time later in the month after several gas shows logged up the hole proved noncommercial.

The latest attempt . . . Gulf came back again August 21, 1956, opened the hole, and set a whipstock at 18,248 ft.

It carried the second sidetracked hole to 18,771 ft., then ran into another disastrous fishing job. The company in mid-December lost the more than 500 ft. of hole it had been able to make in over 3½ months when it gave up as impossible efforts to get back 330 ft. of parted drill pipe stuck at 18,127 ft.

Gulf retreated for the third time up the original hole to 18,061 ft. and set another whipstock.

Last week, the Parker Drilling Co. rig on the job had pushed Sidetracked Hole No. 3 down to 18,198 ft. and was drilling ahead through extremely hard rock at 20-25-ft. daily clip.

No. 3 already has had its first mishap. The operator had to fish for bearings lost out of a bit cone. But this one didn't prove fatal.

Test important . . . In view of all this, it almost goes without saying that Gulf thinks the 1 Northrup is an important venture.

The company, if and when it reaches its 19,200-ft. target depth, hopes to

have had a look at the Siluro-Devonian. The well would be the first to have investigated this deep horizon in the big and promising but perplexing Delaware basin.

The test is being watched with great interest by other large oil firms.

Representatives of some of them think Gulf is convinced it has a good chance to find something pretty big or it wouldn't again be tackling such a formidable opponent.

The company isn't saying anything about this either.

New state mark . . . The state drilling-depth mark hung up by the 1 Northrup in September 1954 has since been cracked twice.

Hunt Oil Co. broke it in February 1955, reaching 18,673 ft. at its 47 Elsinore Royalty Co. dry hole in Pecos County. This one was topped in turn by Magnolia Petroleum Co.'s 417-A West Ranch which was bottomed dry at 19,060 ft. in August 1955 in Jackson County on the Texas Gulf Coast.

The 1 Northrup will again assume the crown if it reaches its projected depth.

Alberta Demand Off

January nominations dip slightly to 441,631 bbl.

CALGARY.—Crude-oil production in Alberta during January will drop slightly below the near record established in December.

Purchasers have asked the Petroleum and Natural Gas Conservation Board for 441,631 bbl. daily during the month, as compared with nominations of 447,896 for December. Of this, 109,116 bbl. daily will go to refineries in the United States.

Offshore tanker shipments from Vancouver will continue to U. S. West Coast refineries at the rate of about 12,000 bbl. daily.

A daily average of 191,205 bbl. will be carried through the Interprovincial pipeline to eastern Canada, and the westbound Trans Mountain line will carry 153,686.

Nominations . . . U. S. refineries will use the following amounts:

Shell Oil Co., Anacortes, Wash., 40,000 bbl. daily; General Petroleum Corp., Ferndale, Wash., 38,561; Standard Oil Co. of California, Western Operations, Inc., 12,000; International Refineries, Inc., Wrenshall, Minn., 11,290; Bay Refining Corp., Bay City, Mich., 6,000; Dow Chemical Co., Midland, Mich., 500; Union Oil Co. of California, Cut Bank, Mont., 265; and Phillips Petroleum Co., Great Falls, Mont., 100.

watching WASHINGTON

. . . with Bertram F. Linz

New kind of surplus . . .

THE oil industry, along with all others, is going to have to "expand like mad" between now and 1975. Rapidly growing population will bring a tremendous increase in demand for oil and other commodities. But the big trick will be to find work for an even faster-increasing labor army.

The Census Bureau has done some figuring on this. It finds that the labor force, now numbering about 70 million, will range between 91 and 94 million by 1975—a 30 per cent increase or better.

There are several factors leading to this. The low birth rates of the 1930's have been a brake on the growth of the labor force. But the birth rate has been much higher since 1940. So while the percentage of young workers will be less in 1960 than it was in 1950, it will expand rapidly thereafter.

Women also will comprise a larger portion of the work force, particularly the group over 35. Already the number of older women has reached a point that was not expected to occur until 1965 or 1970, with no indication of tapering off.

Men over 65 still comprise about 4 per cent. More attractive retirement benefits from social security and company plans are whittling the percentage down, and by 1975 it may be half of what it is now. But regardless of this, the bureau warns, there will be increased competition for jobs, with the possibility of some severe dislocations, as the economy tries to absorb an unprecedented increase in the labor force.

The figures, of course, are based on the assumption that there will be no major war, that marriage and birth rates will remain high, and that a generally high level of employment will continue.

Quick come back . . .

WESTERN Europe's oil supply may be a lot better this winter than was feared 2 months ago.

The area hit by the cut in Middle East supplies had over 2,000,000 bbl. a day last month. It will get still more this month.

Aside from the 500,000 bbl. or more a day to be sent across the Atlantic from the Gulf Coast, it is estimated the area will get 1,700,000 bbl. or more a day from the Middle East and South America. In addition, about 220,000 bbl. daily will be produced in European oil fields.

The crude supply will be sharply cut. It will be under the 2,000,000-bbl. a day mark. But there will be around 550,000 bbl. daily of products which can go directly into consumption.

Washington officials figure that on this basis Europe's oil supply this month will be around 80 per cent of the pre-Suez level. But it is quite possible it will be even better as the Middle East Emergency Committee's world-tanker schedules get into full operation.

Twin targets . . .

ALASKA'S oil lands will be in the news this year. But the question of opening now-closed areas may get tangled up with the bigger question of statehood.

There are 20-odd million acres north of the Brooks Range which the Navy once thought might be added to Naval Petroleum Reserve No. 4. Navy dropped that idea when drilling found Gubik gas field but no oil. Alaskan interests would like to see the area opened up for development and the building of a pipeline to carry the gas to Fairbanks.

The territory wants more than ever to become a state. Last year it elected a "congressional delegation," which will not sit in Congress, as a gentle hint that it wants action. Hawaii also wants to be a state, and there will be a congressional fight in which oil may be forgotten.

Alcoa to check on corrosion as . . .

. . . Aluminum Gas Line Buried

POINT COMFORT, Tex. — Lavaca Pipe Line Co. has completed what is described as "the largest, longest unprotected aluminum gas-transmission line now in service."

It is a 20,000-ft., 8-in. line in Lavaca's system serving the Aluminum Co. of America plant here.

The aluminum line, devoid of protective coatings and anodes, has electrical insulation at certain flanged joints only. Anodes will be installed on test sections to determine their effectiveness. The pipe is buried in soil which varies from sand to silty marsh.

The section will provide a test of aluminum's corrosion resistance without the usual coating, wrapping, and cathodic protection applied to steel pipe. The line was joined in 40-ft. sections with the argon shielded tungsten arc and consumable electrode welding methods. Designed to operate at just under 500 psi., it has been tested at 800 psi. Calculated bursting pressure is 1,500 psi.

We have it but can't move it!

Oil Transport Needed

WASHINGTON.—The domestic oil industry, if pressed, could produce 9,000,000 bbl. of crude daily.

But unless wholly new facilities are built, 1,000,000 bbl. a day could not be moved, even under emergency conditions.

These are the conclusions of an industry committee which made a survey of our ability to fill Europe's oil gap after the cutting down of Middle East supplies. The study, made last fall, was released by Interior Secretary Fred A. Seaton at the week end.

The report strongly supports the idea of a pipeline from the Midwest to the East Coast to provide maximum flexibility in an emergency. The Middle East situation tested U. S. ability to meet drastically changed world-supply conditions. It showed that there are serious gaps in our oil transportation network.

How it would work . . . The 9,000,000-bbl. output represents an increase of 2,100,000 bbl. over the daily average of 6,978,000 bbl. produced last July. Of this increase, 1,850,000 bbl. would come from the Midwest, Gulf Coast, and Rocky Mountain areas, where production has outstripped transportation.

There is no present way of moving more than 8,000,000 bbl. of crude daily, the committee emphasized. And even to get that amount some major shifts in transportation would be necessary.

The ability to produce petroleum exceeds the availability of normal transportation systems, such as pipelines, barges, and tank cars, the committee reported. But under emergency conditions, existing facilities could move 1,100,000 bbl. daily additional, it said.

To do this, however, it would be necessary to increase the flow through pipelines to the Gulf Coast; use railroad tank cars to serve the gulf ports; use excess pipeline capacity to Wood River, Chicago, and Lima, Ohio, and tank cars from those points to the East Coast; and use barges, trucks, and tank cars from the Texas and Louisiana Gulf Coast producing areas to tidewater.

What happened after Suez? . . . An average of 2,633,000 bbl. daily was moved by pipeline to the Gulf Coast last July. By mid-November this was increased to 2,806,000 bbl. daily as the industry geared itself to help Europe.

The net effective pipeline capacity to the Gulf Coast increased 62,600 bbl. daily in the last half of 1956. It totaled 3,295,000 bbl. last month. It is estimated that this is the maximum that can be piped to the gulf under present circumstances.

Reports reaching Washington indicate that pipeline capacity from West Texas to the gulf is being utilized fully under present and planned operating schedules. Additional line capacity to Gulf Coast shipping points is limited to lines originating in East Texas, coastal Texas or Louisiana.

Tough Job Nearly Finished

INSTITUTE, W. Va. — Equitable Gas Co. is nearing completion on its 4 and 5-in. products pipeline which crosses 100 miles of rugged mountains between Maytown, Ky., and Institute.

The line will transport ethane concentrates from Equitable's extraction plant at Maytown to the Carbide & Carbon Chemicals Co. plant at Institute. The plant manufactures ethylene, polyethylene, ethylene glycol, and a wide variety of other products.

Carl E. Smith, Inc., and Richard B. Stout are contractors on the difficult job, which includes several miles of rock cliffs and grades of 60° to 80°. Considerable blasting was required. Part of the line was wrapped with polyethylene tape to prevent corrosion in areas where coal blooms are frequent.

Construction started last August. Completion is scheduled for February 1. The line will go into operation this spring.

Parkersburg Pumper Service is Everywhere

Parkersburg backs up the superior quality of its pumping units with a field service that operators appreciate. No matter where your Parkersburg pumping unit might be located, there's a skilled Parkersburg service crew only a short distance away.

Parkersburg service crews are made up of engineers and highly trained mechanics, all of them on call day or night to assure you fast service. Replacement parts for your pumping unit are available through each of the 20 Parkersburg warehouses strategically located with fast service in mind.* Special requirements can be filled in 24 hours from the Parkersburg pumping unit plant at Coffeyville, Kansas.

This incomparable field service is another reason why your best buy in pumping units is a Parkersburg. Ask your Parkersburg sales engineer for more details.

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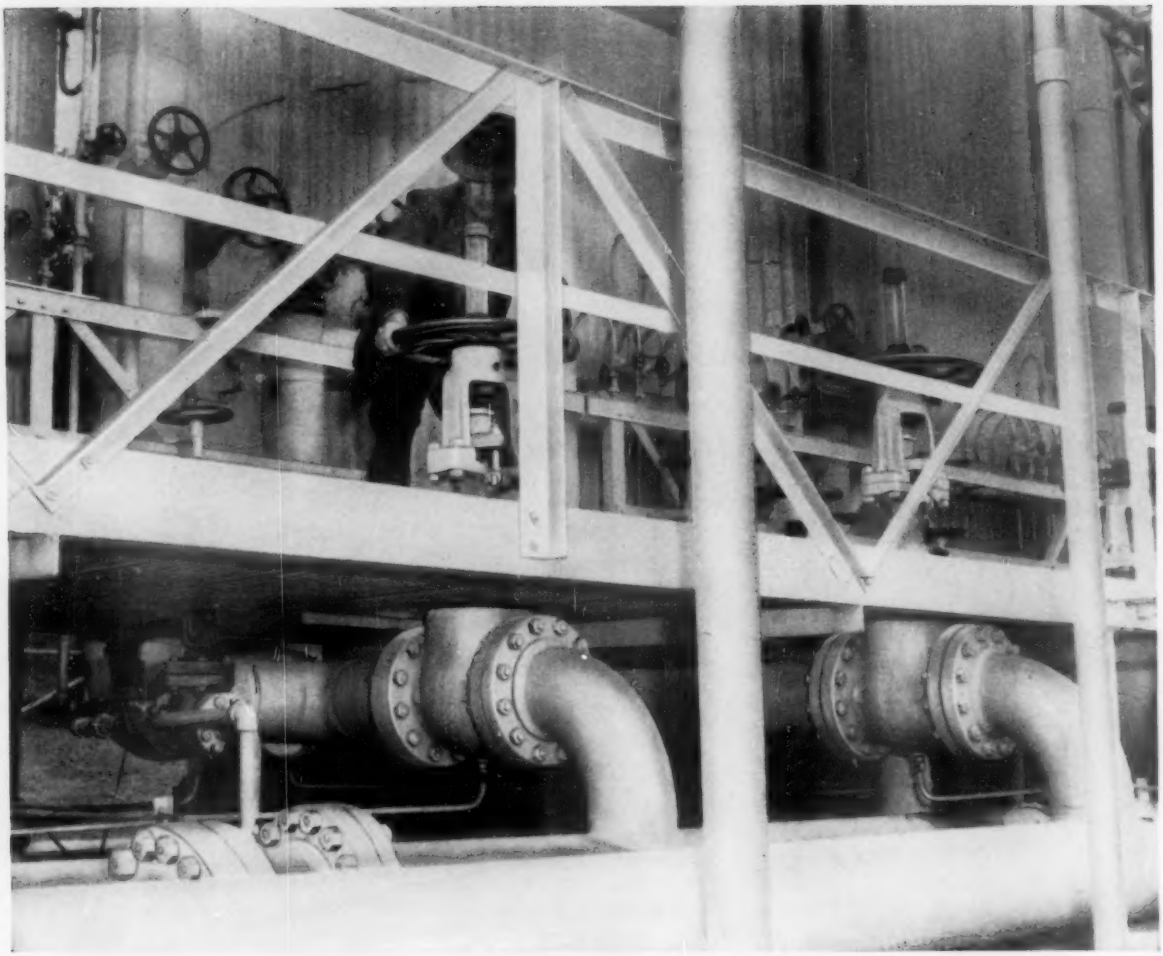


Double Block Protection at Half the Cost —with Crane Flexible Wedge Disc Gate Valves

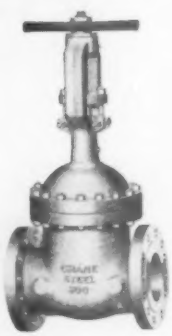
There are real savings in this installation.

The main valves you see in the photo are Crane 33XU steel gates modified with flexible disc—8-, 6- and 2-inch—on the dehydrator in the Phillips Pipeline Company pump station at Borger, Texas. Moisture is removed from the product here, using butane at 450° F. The setup is part of Phillips' 8-inch Borger-Chicago product pipeline, looped in 1951 to handle dissimilar products.

Design features of the Crane flexible wedge disc gate valves are cutting costs across the board. With the flexible disc, positive seal is assured on the upstream as well as downstream side. Each valve does the work of two with solid wedge disc.

Tapped opening is provided in bottom of body which permits bleeding while main valve is closed. Valve and piping costs are cut in half; the operator has only one valve to handle instead of two.

Crane flexible wedge disc steel gate valves can be furnished in sizes 2- to 12-inch, pressure classes up to 1500 lb. Get the facts from your local Crane Representative, or write to address below.



CRANE VALVES & FITTINGS

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Drilling Record Seen

New tests will increase by at least 1 per cent, but key to further activity is Mid-East, forecaster declares

OKLAHOMA CITY.—The petroleum industry will follow up a record drilling year with more of the same in 1957. But just how high the new mark will go depends on a number of variables. That's the way Jack H. Abernathy sees the situation in his drilling review and forecast, issued through the American Association of Oilwell Drilling Contractors. Abernathy is president of the organization and vice president of Big Chief Drilling Co. of Oklahoma City.

J. H. ABERNATHY

Drilling completions for 1956 are estimated at 58,200 wells, with footage reaching 235 million, Abernathy points out. Late December forecasts indicate that U. S. producers will go at least 1 per cent over this, but the figure could be much higher if two predictions materalize. Abernathy lists these as:

. . . A cut in imports. Some Washington sources feel that in the interest of national defense, the Office of Defense Mobilization may order a cutback to near the 1954 ratio to domestic production.

. . . A sufficient growth in demand. Total U.S. demand is expected to increase 4.1 per cent over 1956, from an average of 8,899,000 bbl. daily to 9,265,000. Most of this need will be supplied from domestic production, which is expected to increase 2.6 per cent over the 1956 daily average of 7.1 million barrels.

Since operators plan drilling budgets on the basis of demand and markets, this could result in a moderately stepped-up drilling program in the U.S. and other Western Hemisphere producing countries, Abernathy feels.

Uncertainties over the Middle East situation could boost activity still further. It took the Suez blowout to bring 1956 drilling up to early predictions and its lingering effects could do much to boost the number of wells in 1957.

Abernathy adds that the current best guess is that it will result in an increased foreign demand of about 800,000 bbl. daily for U.S. crude through the first 6 months. This demand would diminish during the remainder of the year.

Abernathy sums up his forecast this way: These various events could mean enlarged drilling programs to maintain domestic reserves and to allow for increased production. But if they do not occur, look for about a 1 per cent hike.

As to the domestic producers themselves, Abernathy reveals, they are adopting a wait-and-see attitude, moving cautiously in planning drilling budgets until they can bring the Middle East situation into better focus.

Costs going up . . . Producers can expect to pay more for their wells in 1957, Abernathy warns. He points out that a delayed reaction—not yet fully realized—from the steel strike will push direct drilling costs higher.

Oil country casing and drill pipe prices went up about $14 a ton. This alone means from $20 to $40 per rig per day in added costs to the contractor, he said. Wages also went up.

Contractors, who drilled about 93 per cent of the nation's oil and gas wells last year, have traditionally held the line against cost by increasing penetration rates.

The rates appear to have increased some in 1956 and they might do so again in 1957. But it won't be enough, Abernathy says. The net result will be reflected in higher footage costs. And the producer will have to foot part of the extra bill.

K. L. AUSTIN | O. D. FERRIS | JON VINSON

Series begins on PETROdatics:

How to Use Electronic Computers

FIRST article in The Oil and Gas Journal's easy-to-read series on electronic computers appears this week on page 129.

This new feature — PETROdatics— presents the use of electronic computers in all divisions of the oil and gas industry and has been prepared by officials of DATICS Corp., a new Fort Worth firm with offices in the Continental Life Building.

Each author has had extensive experience in both the oil industry and in electronics work.

The initial article is an introduction to digital computation, entitled "How Electronic Computers Operate." It was written by K. L. Austin, president of DATICS Corp. (See photo.)

Other authors of the series will include O. D. Ferris, director of operations; Jon Vinson, datatician; Dan W. Patterson, director of data-reduction services; Robert L. McIntire, director of computing services; and John M. Ryan, director of data processing.

The second article in the PETROdatics series will appear in the January 21 issue.

DAN W. PATTERSON | ROBERT L. McINTIRE | JOHN M. RYAN

Texas Puts Lid On Output

● Commission holds line on allowables by permitting 16 producing days in January; it's victory for independents

AUSTIN.—A badly-split Texas Railroad Commission has decided to go down the line with Texas producers and hold the line on oil allowables for January at 16 producing days.

This is the same as for December plus that allowable for newly completed wells. The January allowable will be 3,421,058 bbl. daily. New wells probably will build up this total about 38,000 bbl. by the end of the month.

The commission's decision, delayed 10 days, was a victory for the independent producers and a defeat for major crude-buying companies.

The majors overwhelmingly favored a hike to 17 and even 18 producing days. The latter schedule would have hiked the allowable more than 300,000 bbl. daily. It also would have meant producing roughly 250,000 bbl. daily more oil than Texas has ever produced.

Texas producers, other than most of the majors, fought at the December 19 monthly hearing against any increase in allowable until:

... Unconnected Texas wells "now numbering more than 7,700" get pipeline connections.

... All pipeline-prorated wells are again producing their full allowables.

... Crude-oil stocks come down to levels recommended by the industry.

... Surplus gasoline stocks, now depressing crude prices, are used up at least in part to help supply Western Europe's petroleum needs.

The independent's position was a drastic switch from that historically taken prior to the Suez crisis when they called for higher allowables.

Their viewpoint now is that government officials and the public cannot help but see the vulnerability of Middle East oil. It would be short-sighted, they think, to permit the state's surplus oil to be taken now, reasoning that they would be even worse off when the European crisis ends.

On the other hand, producers in Texas think they stand a good chance of getting a crude-price hike if they can lower stocks. Unconnected wells and pipeline proration should end too.

Short of goal . . . The Bureau of Mines estimates demand for Texas crude during January at 3,650,000 bbl. daily. The commission estimates actual production in Texas during the month at 3,044,024 bbl. daily. This is a gap of more than 600,000 bbl. a day.

If estimates of both bodies should prove correct, the federal Government's aim to hike Gulf Coast liftings 600,000 bbl. daily to Europe and 300,000 bbl. daily to the East Coast would appear doomed to fail.

Evidence indicates that already tankers which had been en route to Gulf Coast ports have been rerouted around Africa to take oil from the Persian Gulf instead.

No joint statement . . . Hints from commission members that there was a disagreement over what to do with allowables in January were confirmed when no joint statement was issued.

Gen. E. O. Thompson, veteran member, said the 16-day schedule was retained primarily because state and national stocks were increasing.

Weight may be the secret as . . .

. . . Penetration Rates Studied

ODESSA, Tex.—The American Association of Oilwell Drilling Contractors is undertaking a special engineering study to shed light on two important questions:

What effect does bit weight have on drilling time?

How does rotary table speed affect drilling?

The experiment will be made at a deep test near Dora Roberts pool in Ector County. Cooperating in the project are Texas Gulf Producing Co., operator of the well, and Exploration Drilling Co., which has the contract.

Initially, the project will determine how weight on the bit affects penetration rates. Rotary table speeds will be kept constant during this phase of the study. The effect of changes of weight on the bit in various formations will be studied in detail.

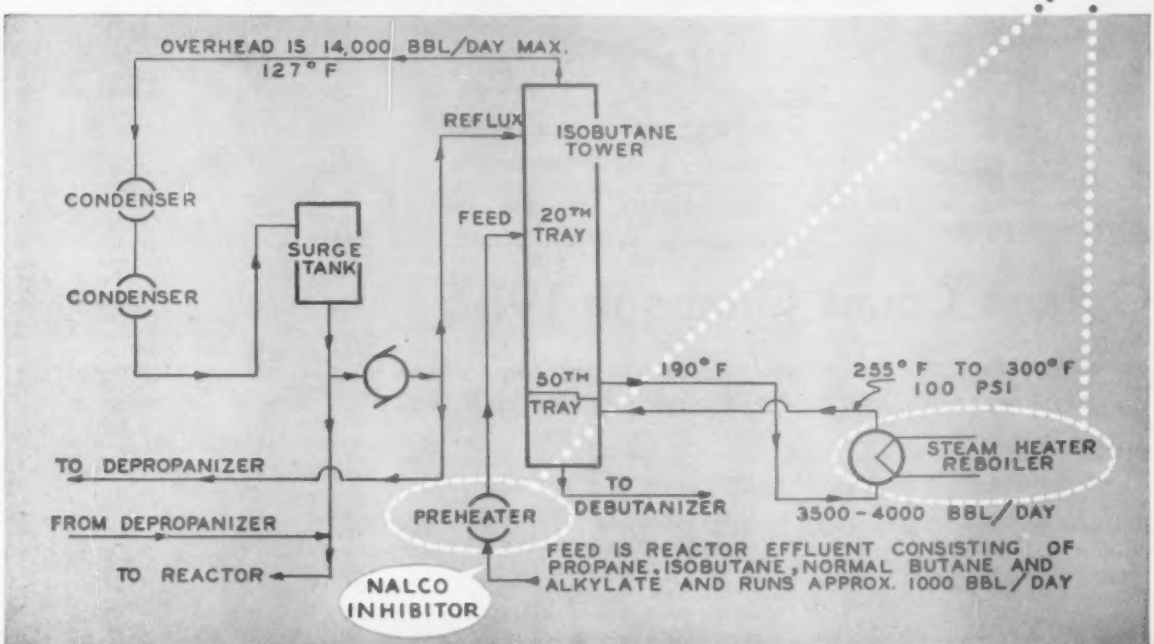
Second phase of the project will determine how changes in rotary-table speed alter penetration rates. Then the two factors will be altered, keeping the product of bit weight and rotary table speed constant, to see what relationship exists between these factors and penetration rate.

During the tests, all factors affecting drilling operations are automatically recorded. At the end of each day, the results are evaluated and plotted by project engineers.

William P. Clements, Jr., Dallas, chairman of the A.A.O.D.C. rotary drilling committee, said that the weight-speed vs. penetration project is one of several field experiments now under way by the association, in search for improved drilling methods.

Nalco INHIBITORS GET RESULTS AT THESE TYPICAL TROUBLE-SPOTS

IN AN H_2SO_4 ALKYLATION SYSTEM



THE PROBLEM	THE TREATMENT	THE RESULTS
1. *Corrosion* in the preheat exchanger of the isobutane tower. 2. *Fouling* with ferric sulfate and hydrolysis products of esters of H_2SO_4 in the reboiler of the isobutane tower.	Nalco Inhibitor fed to the isobutane tower at first month rate of 20 ppm with subsequent reduction to 10 ppm.	Reboiler pressure drop held to 25-28 psi. No decrease in reboiler coefficient. No problem of corrosion or deposits during more than a year of operation with Nalco treatment.

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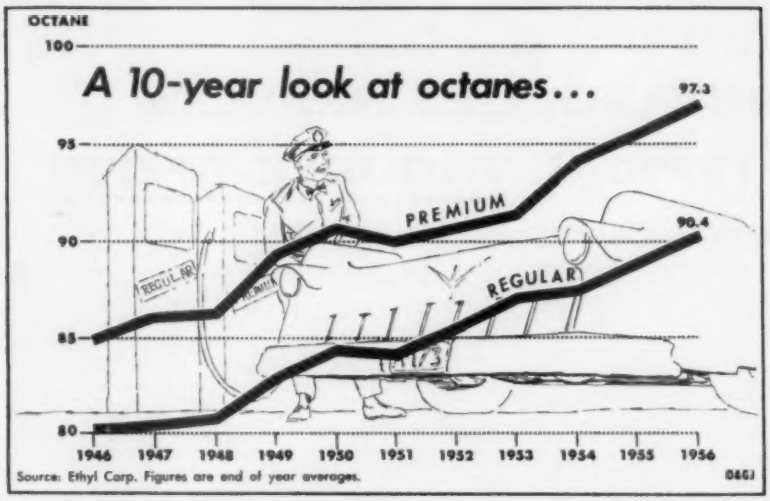


Octane Count Climbs in 1956

● **But the rate of increase for premium and regular was at a slower pace, and the trend may continue during 1957**

NEW YORK. — Octane ratings for both premium and regular gasoline continued to rise in 1956, but the rate of ascent was somewhat less than in either of the 2 preceding years.

This is revealed in Etyhl Corp.'s monthly survey of antiknock quality for December. The survey showed a national weighted average of 97.3 octane number for premium and 90.4 for regular.

Premium was unchanged from November but increased 1.2 numbers above December, 1955. Regular was up 0.1 from November and 1.5 from December a year ago.

The 1956 increase in premium octane ratings of 1.2 compares with increases of 1.8 for 1955 and 1.6 for 1954. The lesser gain last year may be the beginning of a trend to smaller annual increases. It is expected that 1957 will show a still smaller increase.

If such a trend does develop, it would be welcomed by the oil industry because of the high cost of higher octane numbers. Whether it is actually the beginning of a trend or merely a reflection of the introduction of superpremium grades is conjectural. The Ethyl survey does not include the newer peak octane motor fuels.

Another development of possible significance is the narrowing spread between premium and regular. The spread dropped from 7.2 octane numbers in 1955 to 6.9 in 1956. This could, however, be more a reflection of the absence of superpremiums from the survey than a positive indication that the difference between regular and top quality gasoline is narrowing.

New emphasis on 99 . . . The December report showed greatly increased emphasis on 99-octane gasoline and higher. Twenty-two samples of 99 or higher octane were picked up in December, compared with only 12 in November.

Four companies retailed motor fuel of this grade in December—two on a highly local basis, but two on a wide front. One of the former was reported from Dallas, and the other from Cleveland.

One of the latter, which has been marketing 99-plus for several months, now sells this grade in 10 cities: Atlanta, Baltimore, Birmingham, Boston, Charlotte, Cleveland, Jacksonville, Memphis, New York, and New Orleans.

The other, in the 99 and higher grade for the first time in December, is retailing this grade in Boston, Cincinnati, Corpus Christi, Jacksonville, Little Rock, Louisville, Memphis, New Orleans, and Philadelphia.

Breakdown by cities . . . Comparison of the December reports from 1956 and 1955 shows that in 1956 forty-one of the 53 cities were in the 96 to 97.9 category whereas a year earlier 40 were in the 94 to 96.9 range for premium. Eight cities had 98 octane or better averages in December 1956, against none the year before.

In the regular grade in December 1956, 34 cities had an average octane of 89 or better while a year earlier, 33 of the 53 had an average of less than 89. Nine cities had an average of 92 or better last month against none in the like month of 1955.

Peak octanes for the two grades reported in December were: Premium, 99.5, Boston, Memphis, and New Orleans; and regular, 94.4, Boston, Buffalo, Cleveland, and Hartford.

The following tables give a breakdown on the two grades:

PREMIUM
(Cities per octane group)

Group—	Dec. 1956	Nov. 1956	Dec. 1955
91-91.9	0	0	1
92-92.9	0	0	1
93-93.9	1	2	1
94-94.9	3	2	12
95-95.9	0	1	11
96-96.9	18	18	17
97-97.9	23	26	10
98-98.9	8	4	0
Total cities	53	53	53
Wtd. ave. R.O.N.	97.3	97.3	96.1
Wtd. ave. TEL, me. per gal.	2.50	2.54	2.48

REGULAR
(Cities per octane group)

Group—	1956 Dec.	1956 Nov.	1955 Dec.
82-82.9	0	0	1
83-83.9	1	1	1
84-84.9	0	0	1
85-85.9	1	2	1
86-86.9	6	4	15
87-87.9	5	6	3
88-88.9	6	9	11
89-89.9	15	11	8
90-90.9	1	4	10
91-91.9	9	9	2
92-92.9	9	7	0
Total cities	53	53	53
Wtd. ave. R.O.N.	90.4	90.3	88.9
Wtd. ave. TEL, ml. per gal.	2.07	2.18	2.22

Well-Service Group to Meet

FORT WORTH.—The newly organized Association of Oilwell Servicing Contractors will hold its first annual meeting at the Hotel Texas here January 18-19.

The 2-day session will begin with a luncheon for officers, directors, chapter chairmen, and committeemen, followed by an afternoon general session.

Opening address will be by Frank M. Pool of Pool Well Servicing Co., San Angelo, Tex., president of the association. The first session will include a paper by Floyd W. Smith of Technical Drilling Service, Midland, entitled "Application of Air Drilling Techniques to Workovers and Cleanouts with Well Servicing Equipment."

An all-day session January 19 will feature four papers: "What Industry Expects of the Well Servicing Contractor," by Joe M. McLaughlin, Magnolia Petroleum Co., Dallas; "Forecast for the Oil Industry," by French M. Robertson, independent producer, Abilene, Tex.; "Safety and Insurance," by E. C. McFadden, Texas Employers Insurance

Association and Employers Casualty Co., Dallas; and "Taxation and Depreciation," by Vester T. Hughes, tax counselor, Dallas.

The new association is headquartered in Odessa, Tex. Executive secretary is W. H. (Woodie) Fox.

Looping Completed

Plantation project finished just before end of year

ATLANTA. — Plantation Pipe Line Co. beat the deadline for completing its 1956 looping project by an hour and 35 minutes.

First deliveries of products through the new 327-mile section of 18-in. from Baton Rouge to Helena, Ala., were started at 10:25 p.m. December 31.

Three spreads worked on the last 15 miles to expedite completion. The job was started in June but delayed almost 2 months by late pipe deliveries because of the steel strike. The entire project was contracted by Oklahoma Pipe Line Constructors.

The loop makes it possible to increase initial throughput by 60,000 bbl. daily and raise the total for the system to 305,000 bbl.

The project just completed is the first step toward developing the third parallel line for Plantation's main trunk line. This loop will be extended in two more steps later to complete a third continuous line from Baton Rouge to Greensboro, N. C.

Present throughput of 305,000 bbl. daily is five times the volume pumped through the original 12-in. line which Plantation started up 15 years ago.

Beaird Merges with A.M.F.

SHREVEPORT, La.—J. B. Beaird Co., Inc., a leading maker of packaged compressors and the world's largest manufacturer of L.P.G. systems, has merged with American Machine & Foundry Co. of New York, a large diversified manufacturing firm.

The deal involved exchange of 10,000 Beaird shares for approximately 155,000 shares of A.M.F. stock.

Beaird will continue to operate under its present name and with the present personnel. President of the Shreveport-based firm is J. Pat Beaird.

Beaird plants are also located in Clinton, Iowa, and Stockton, Calif. This year the firm acquired tank-manufacturing facilities of Butler Manufacturing Co. in Galesburg, Ill.

Diversified manufacturing by A.M.F. includes oil-well drilling and recovery equipment, manufactured through its subsidiary, American Iron & Machine Works Co., Oklahoma City.

Processing briefs

Wyandotte Chemical Corp.'s proposed $20-million electrolytic chlorine-caustic manufacturing plant at Baton Rouge will be designed and built by Fluor Corp. To be known as the Geismar Works, the large-capacity plant will increase Wyandotte Chemical's caustic soda and chlorine manufacturing capacity by 60 per cent. Completion is scheduled during the last half of 1958.

The joint A.P.I.-A.S.M.E. committee on unfired pressure vessels has been discontinued. An announcement of intent failed to bring any objections. The move came after it was decided "that the whole engineering profession has come to agree with the engineers of the petroleum industry on the design and construction of safe pressure vessels for use in the process industries."

A third Ultraformer will be built by Standard Oil Co. (Ind.) at its Whiting, Ind., refinery. The latest 21,000-bbl. unit is scheduled for completion early in 1958, and will increase Ultraforming capacity to 56,000 bbl. daily at Whiting. The new unit will supplement a 14,000-bbl. unit which began operating this summer, and a 21,000-bbl. unit scheduled for completion early in 1957. Arthur G. McKee Co., Cleveland, is the prime contractor for the new Ultraformer.

The new unit brings to 14 the total number of Ultraformers operating or planned for Indiana Standard and affiliated companies. An additional 10 units are licensed to other companies.

Imperial Oil, Ltd., will add a Powerformer and a Hydrofiner at its Winnipeg refinery. It also plans to boost the refinery's crude capacity from 15,000 to 17,500 bbl. daily. Contract for the new construction has been let to Foster Wheeler, Ltd. Completion is scheduled for early 1958.

A new petrochemical product, hexylene glycol, is being added to the production line of B.A.-Shawinigan, Ltd., plant at Montreal East. The new chemical is used for brake fluids, printing inks, and textile treatment.

It joins isopropanol as the second derivative of acetone originating from light gases produced in the adjacent Montreal refinery of British American Oil Co., Ltd. B.A.-Shawinigan converts cumene received from British American to acetone and phenol. Existing equipment will be used for making hexylene glycol.

New catalytic-reforming unit is being planned by British American Oil Co., Ltd., for its Edmonton refinery. The unit will use the Catforming process licensed by Atlantic Refining Co. and will have a capacity of about 2,000 bbl. per day. Completion is planned for late this year.

Jet-fuel production will start late this year at the Mandan, N. D., refinery of Standard Oil Co. (Ind.). Ultimate capacity will reach 1,000,000 bbl. per year. New blending, storage, pumping, transport-truck, and loading-rack facilities will be installed this year to handle the new product.

Ford now has a supercharged engine. The 300-hp. engine is being offered on standard models and the Thunderbird for an extra $447.40. The engine will burn regular-grade gasoline. It will replace Ford's 285-hp. dual four-barrel carburetor V-8 model, formerly the most powerful engine in the Ford line.

Also for Refiners . . .

Refiners across the nation will quickly feel the effects of Humble raising crude prices (P. 75) . . . A new isomerization process that promises a short payout time is being offered refiners who need to upgrade their high-octane pool. It's M. W. Kellogg's "Iso-Kel" process (P. 76) . . . U. S. refiners are scheduled to get about 110,000 bbl. of crude daily from Alberta fields during January (P. 81) . . . The rate of increase in octanes may be slowing down. Ethyl's December survey shows premium gained only 1.2 numbers during 1956 while regular climbed 1.5 numbers (P. 88) . . . Phillips Petroleum's annual L.P.G. survey shows sales climbed 16.7 per cent in 1956 to 6,997,000,000 gal. (P. 92) . . . Shell's expansion plans include a new 55,000 to 60,000-bbl. refinery in Germany (P. 95).

PLUS THESE TECHNICAL FEATURES: Refinery switchgear is getting safer. And it's versatile, too. It can be made an almost universal tool in the electrical power systems for refineries, and it's good indoors or out (P. 102) . . . Shell puts radioisotopes to work improving refining operations (P. 111) . . . PETROdatics, a new series on electronic computing (P. 129) . . . Equipment design and operation (P. 130) . . . Cost-imating (P. 131) . . . The Foreman's Page (P. 135) . . . and Refiner's Notebook (P. 137).

Florida Line Shaky

FPC gives approval, but attaches tough conditions which it doubts can be met; companies still confident, however

WASHINGTON.—With a $148-million natural-gas line hanging in the balance, officials of two pipeline companies were working fast last week to keep their plans for moving Texas gas to Florida from collapsing. Their goal: Revise tariffs upward and talk customers into accepting them.

The FPC approved the 1,516-mile pipeline proposed by Coastal Transmission Corp. and Houston Texas Gas & Oil Corp. But it hedged the approval with stiff conditions which call for extensive refiguring of the project's economics.

The commission agreed that the line would have a gas supply fully adequate to support it, and that markets are "ready and waiting" in Florida. But it aimed heavy objections at the tariff provisions of the setup. The commission admitted the changes it demanded are "substantial" and expressed doubt that they can be met.

F. E. Stanley, chairman and president of Houston Texas Gas & Oil, said he is sure they can be, however. He and other officials of the companies went to work revising tariff and financing plans immediately after the FPC hearing. They were given 30 days to submit the new ones.

Conditional approval was granted shortly before the December 31 deadline on which some of the gas-supply contracts would otherwise have expired. The proposal barely squeaked through the commission, with two of the five members dissenting.

The FPC was chiefly critical of the manner in which rates had been set up. Its conditions will require substantial changes.

The conditions . . . Houston Gas is ordered to make each class of service bear its proper share of the costs, based on a 6 per cent rate of return. It is to eliminate the cancellation and reduction-in-take provisions in the transportation agreements with the two power companies which will be major customers. It must modify its minimum-bill provisions and eliminate the cancellation provisions in the contracts covering direct primary interruptible service.

Coastal will have to provide separate charges for gas sold to Houston Gas and that transported for the power companies. These are to be based on an allocation of costs between the two services. For the first 6 months of operation, they are to be based on a 6 per cent rate of return, but for succeeding 6-month periods must be on the over-all annual rate of return of the two companies, as figured in the previous half-year, but not more than 6 per cent.

Coastal is also required to credit federal income tax accruals in its allowance for working capital, eliminate an escalation provision applying to gas from its own reserves, and modify the provision which gives credit to Houston Gas when Coastal removes heat content from gas it buys and transports. The company must either extend that credit to its own production or eliminate it completely.

What dissenters said . . . A dissenting opinion filed by Commissioners William R. Connole and Arthur Kline predicted that the plan outlined by the majority is not practical and will not solve the problem. The rates required, they said, will raise the price of service "beyond economical tolerance."

The project as proposed is "economically impossible of completion," Connole and Kline asserted. The Florida power companies are interested in gas only if it is cheaper than alternative fuels, they said. To expect a major utility to increase its operating expenses to subsidize a "significant competing source of energy" is "stretching one's confidence in corporate magnanimity to the breaking point."

The new tariff to be filed will apply to users of 60 per cent of the line's capacity, it was pointed out. It is "unrealistic" to expect it would ever be accepted, and if accepted would be used for a very short period, the dissent said.

"Consideration of public policy or national defense which might motivate acceptance are beyond our jurisdiction to consider or to implement," Connole and Kline declared. "Therefore, as much as 60 per cent of the line capacity would soon be unused. No firm market nor supply has been shown for that much unused capacity on this record."

Who is buying . . . Under the proposal which FPC threw out, price of gas going into Florida would fluctuate with the price of Bunker "C" and stay far enough under the level for fuel oil to make its use profitable. Two utilities in Florida would purchase the gas directly from producers, with the pipeline collecting a transportation fee *(The Oil and Gas Journal, November 12, page 138).*

Florida Power & Light Co. has contracted for 100,000,000 cu. ft. daily from Sun Oil Co., Magnolia Petroleum Co., and La Gloria Oil & Gas Co. Some 800 billion cubic feet of reserves is involved. Florida Power Corp. has purchased 50,000,000 cu. ft. per day from Pure Oil Co. and Sun.

At the level of fuel-oil prices when contracts were made, Florida Power & Light signed for 18½ cents per M.c.f. in Texas. Florida Power's price was 21½ cents in Louisiana for 1,000 B.t.u. gas.

Interprovincial Loops Let

REGINA, Sask.—Contracts for looping four sections of the Interprovincial pipeline in Canada and the U.S. have been let.

Fulton-Bannister of Edmonton, Alta., will string 32.6 miles of 24-in. line from Kendal, Sask., to near Peebles. Construction on this section is scheduled to start June 1 and be completed by the end of July.

R. H. Fulton & Co. of Lubbock, Tex., has the contract to build 78.4 miles of 26-in. line in Minnesota and Wisconsin. The first section will be 34.4 miles from Clearbrook, Minn., to near Bemidji. A 25½-mile section will be laid from Deer River, Minn., to Blackberry, and 18.5 miles will be laid from Wrensall, Minn., to Superior, Wis. Construction is expected to run from June 1 to August 31.

The projects will mean a minimum of two lines in operation from Regina to Superior. Total cost is estimated at $8,000,000.

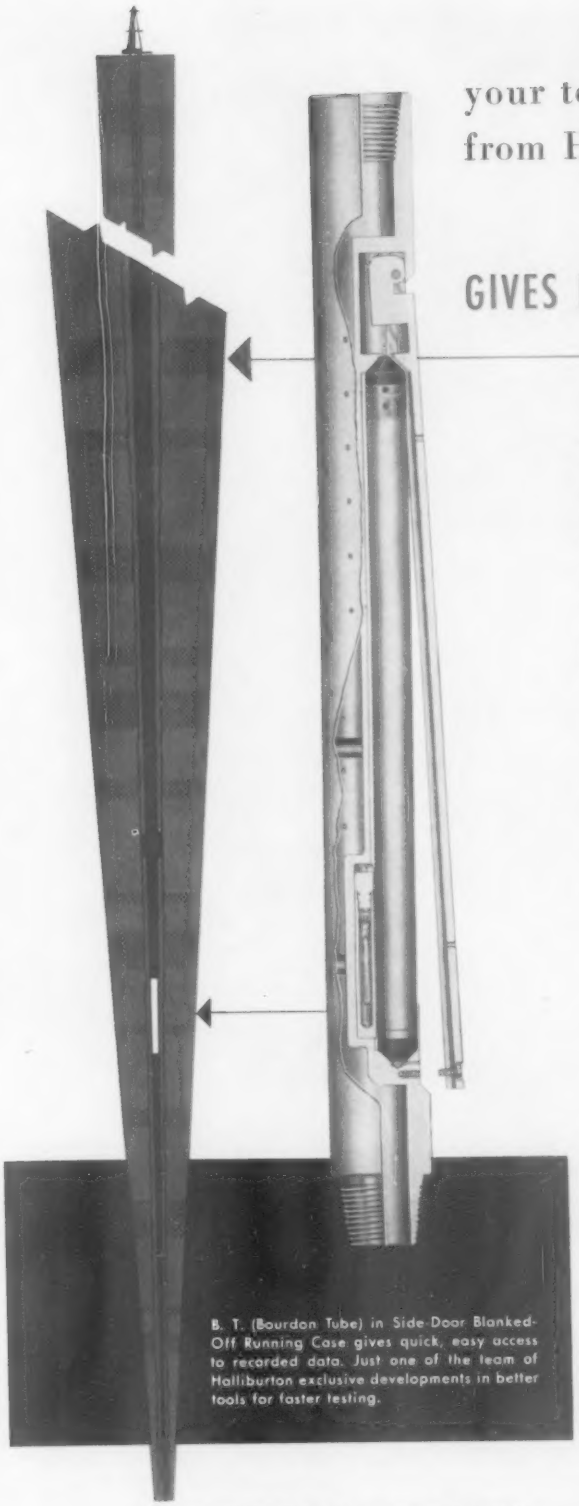
Phillips Lines Completed

BARTLESVILLE. — Phillips Petroleum Co. has completed a 139-mile, 12-in. looping project which will increase capacity of its Borger to St. Louis products line by several thousand barrels daily.

Construction was handled by Groninger & King, Mitchell Construction Co., Inc., and M. L. Hulcher Co., Inc.

Phillips also has announced completion of other phases of its 1956 pipeline construction program. Panama-Williams Corp. laid a 74-mile, 4 and 6-in. ethylene line from Phillips' Sweeny refinery to its polyethylene plant near Houston. The Houston plant will produce 110,000,000 lb. per year. A 17-in. propane line was laid also in the Houston area.

A 450-mile, 2 to 24-in. gas gathering system in West Texas was Phillips' biggest single project on a mileage basis. The job was contracted to Vaughn & Taylor Construction Co.



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251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

GREATER DEMAND for L.P.G. is reflected in expanding distribution facilities. Domestic and motor-fuel usage account for the biggest share of sales.

New plants, storage planned as . . .

. . . L.P.G. Sales Shatter Record

BARTLESVILLE, Okla.—Increase in L.P.G. production and storage facilities in 1957 may pave the way for a repeat performance of record sales in 1956.

The volume of increase last year was the greatest in history, with sales totaling 6,997,000,000 gal. This is 1,001,000,000 gal. more than in 1955, a growth of 16.7 per cent.

House heating is still the largest single factor in domestic L.P.G. growth, Phillips Petroleum Co. reported in its annual year-end L.P.G. roundup. Combined domestic and motor-fuel market last year was at an estimated 4,068,000,000 gal.—an increase of 17.8 per cent.

Twenty-six new plants came on stream in 1956 to boost L.P.G. production capacity by almost 1,120,000 gal. daily. It is estimated that 15 new plants will be added in 1957 to further increase capacity by almost 750,000 gal. per day.

Underground storage capacity at the end of 1956 totaled almost a billion gallons. Storage space for another 330,000,000 gal. is either under construction or in the planning stage.

Here is a breakdown of contributing factors to last year's record year:

. . . **Motor-fuel sales** increased 30 per cent to 850,000,000 gal. The new federal highway program will mean more opportunities for new and expanded applications.

L.P.G. tractor production increased 4.5 per cent in 1956, although total tractor production decreased more than 25 per cent.

. . . **Chemical manufacture** of L.P.G. increased 20.1 per cent for a total of 1,642,000,000, although the steel strike delayed construction of petrochemical plants.

The big increase, as in 1955, was sparked by the growing demand for polyethylene. The number of polyethylene plants now under construction assures substantial gains for 1957.

. . . **Industrial and miscellaneous use** of L.P.G. swung upwards 10.4 per cent in 1956, for a total of 614,000,000 gal.

. . . **Utility use of L.P.G.** maintained its upward trend, for an estimated total of 234,000,000 gal. — an increase of 9.5 over 1955. Greater interest is being shown in reforming L.P.G. for utility gas purposes, and in providing underground storage by utilities for peak periods.

. . . **Manufacture of synthetic rubber** components through the use of L.P.G. increased another 8.1 per cent to 439,000,000 gal. in 1956. This substantial increase is significant coming on top of 1955's 32 per cent increase.

Transportation facilities are keeping pace with increased production and demand. Four new pipelines were announced or under construction for L.P.G. and refined products.

One new L.P.G. tanker was placed in service during the year, the Phillips report pointed out, and an estimated 22,000 tank cars were in L.P.G. service at the peak of the season.

—— *Industry* briefs

Oklahoma and Kansas also have increased their production allowables for January. Oklahoma's was jumped 15,000 bbl. daily and Kansas' 12,000 bbl. daily.

The Oklahoma Corporation Commission allowed an increase by ordering a 10 per cent across-the-board larger allowable. This applied to allocated and unallocated pools. Officials estimated this will raise the daily allowable to 620,000 bbl., a 15,000 bbl. daily increase over December.

The Kansas Corporation Commission pegged that state's January allowable at 350,000 bbl. daily, highest in history. The previous high production was 345,000 bbl. in January and February 1956.

Colorado Oil and Gas Conservation Commission has ordered a 200-bbl.-daily limit on oil production from J-sand wells in the Beall Creek field in northeastern Colorado's Logan County.

The commission declared that uncontrolled production has been causing underground waste and abuse of correlative rights of some owners in the field. It also found that continued excessive and disproportionate withdrawal of oil from the J-sand reservoir would cause nonuniform encroachment of water into the oil zone.

Eugene Du Pont III and Nicholas R. Du Pont of Delaware & Beacon Building Corp. have purchased producing properties formerly owned by the R. H. Fulton interests of Lubbock, Tex. Sale was made by Polk Avenue Trust Co. of Houston. Oil & Gas Property Management, Inc., will operate the properties. The sale involves 121 oil wells, 21 gas wells, and 80,000 acres of undeveloped leaseholds.

Myron Kinley, Houston wild-well expert, has snuffed out a fire when raged for nearly a week at Hudson's Bay Oil & Gas Co.'s 5-36 Union Liberal in the Sturgeon Lake field of northwestern Alberta. Before it was killed, the well spewed 1,000 bbl. of oil and 1 million cubic feet of gas daily. A $300,000 rig was lost in the blaze.

Practices and problems of the various states in disposal of oil-field brine are covered in a series of reports now being compiled by the research committee of the Interstate Oil Compact Commission. The committee chairman, Dr. A. H. Bell of the Illinois Geological Survey, says that most of the state reports are now in and that he expects to have them ready for publication at the summer meeting of the compact.

SOUND WELDS WITH BETHLEHEM HEADS

Bethlehem Flanged-and-Dished Heads are easy to weld because they are made from grades of steel of uniformly high quality. And they come in a wide variety of types.

Types furnished include ASME Code flanged-and-dished, standard, elliptical, flanged-only, dished-only, shallow-dished, tank-car, obround, and double-dished. Diameters: Up to 144 in.; thickness: 14 gage to 2½ in.

Bethlehem also produces standard manhole and hand-hole saddles, covers and fittings. We also furnish heads with flued openings. To help you maintain production schedules, Bethlehem stocks a number of flanged-and-dished heads for prompt delivery. Write to the nearest sales office for our stock list, or full information on heads for your requirements.

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BETHLEHEM STEEL

BETHLEHEM STEEL

How World Output Looked Before Suez

● Free-world production in October climbed to a new record, but domestic output was off 88,000 bbl. daily

FREE-WORLD crude production was at an all-time high of 15,204,100 bbl. daily in October, the sixth record-breaking month in 1956.

The month also was the final period of "normal" operations before the closing of the Suez Canal and the disruption of the flow of crude from the Middle East through the Iraq-Mediterranean pipeline system.

At least several months will pass before major producing companies can have a share in world markets in the same proportion as in "normal" October. After the Iranian nationalization crisis in 1951, the picture was never quite the same again.

The month was typical in that free-world production outside the United States continued to outstrip domestic output. Areas other than the U.S. averaged 8,238,100 bbl. daily, a gain of 218,800 bbl. daily over September.

U. S. output was off 88,000 bbl. daily to 6,966,000 bbl. daily. This compares with the January-October average of 7,130,000 bbl. daily. Due to the continued increases in other countries, the U.S. share of total output declined further to 45.8 per cent.

Here is the picture in other big producing areas:

...Companies operating in Venezulea increased output by 43,000 bbl. daily to reach 2,536,000 bbl. daily, the fifth record in a row. This level of output accounted for 16.7 per cent of the free-world total.

World-Wide Crude-Oil Production

(Daily average in thousands of barrels)

Country—	Oct. 1956	Sept. 1956	Oct. 1955
Western Hemisphere:			
Argentina	82.9	82.9	84.5
Bolivia	9.0	9.0	8.3
Brazil	19.6	11.6	6.4
Canada	494.0	503.8	405.6
Chile	10.3	10.3	8.5
Colombia	121.8	122.8	111.1
Cuba	1.6	1.7	1.4
Ecuador	9.7	9.7	10.0
Mexico	260.0	260.0	210.9
Peru	51.3	52.2	46.4
Trinidad	84.1	80.2	71.4
Venezuela	2,536.0	2,493.0	2,215.4
Total	3,680.3	3,637.2	3,179.9
W. Europe & Africa:			
Algeria	0.5	0.5	1.1
French Morocco	2.0	2.0	2.0
Egypt	39.6	39.6	36.4
Austria	65.4	65.4	68.6
France	26.5	26.8	20.7
West Germany	70.2	70.6	63.9
Italy	15.2	13.6	5.4
Netherlands	21.8	21.5	19.8
Turkey	6.5	6.5	3.7
United Kingdom	1.2	1.2	1.1
Yugoslavia	5.9	5.9	5.1
Total	254.8	258.6	227.8
Middle East:			
Bahrain	30.0	30.0	30.1
Iran*	638.0	581.0	354.0
Iraq†	765.0	766.6	715.1
Israel	0.7	0.7	
Kuwait	1,203.9	1,123.6	1,127.0
Neutral Zone	50.0	50.0	29.0
Qatar	130.9	122.0	119.6
Saudi Arabia	1,054.9	1,047.9	1,002.4
Total	3,873.4	3,721.8	3,377.2
Other Asia:			
British Borneo	117.0	117.0	116.0
Burma	4.5	4.5	4.9
India	9.2	9.2	5.7
Indonesia	280.0	257.0	231.7
Japan	5.9	5.9	6.3
New Guinea	7.3	7.4	7.9
Pakistan	5.7	5.7	5.7
Total	429.6	406.7	378.2
Free World:			
Foreign	8,238.1	8,019.3	7,163.1
United States	6,966.0	7,054.0	6,831.0
Total Free W.	15,204.1	15,073.3	13,994.1
Communist Countries in Soviet Orbit:			
Romania	200.0	200.0	150.0
Russia	1,600.0	1,600.0	1,400.0
Others	50.0	50.0	50.0
Total	1,850.0	1,850.0	1,600.0
World total	17,054.1	16,923.3	15,594.1

*Includes estimated 4,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 5,000 bbl. daily this year and 12,000 bbl. daily in 1955 from Naft Khaneh field, operated by British Petroleum Co. rather than I.P.C.

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where complete current reports are lacking. Communist countries in the Soviet orbit includes satellite countries in Europe and Red China.

TREND OVER THE LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total, non-Communist countries
1955—			
October	3,179.9	3,377.2	7,163.1
November	3,255.0	3,386.0	7,248.3
December	3,298.5	3,316.1	7,227.2
1956—			
January	3,363.7	3,392.6	7,368.5
February	3,426.2	3,415.7	7,453.4
March	3,471.2	3,624.3	7,713.8
April	3,320.5	3,736.6	7,690.8
May	3,356.5	3,793.9	7,788.1
June	3,519.1	3,713.7	7,871.7
July	3,549.8	3,806.1	7,996.6
August	3,618.2	3,685.8	7,965.6
September	3,637.2	3,721.8	8,019.3
October	3,680.3	3,873.4	8,238.1

...The Middle East also fared well. It gained 151,000 bbl. daily for a record 3,873,400 bbl. daily, or 25.4 per cent of the total.

...Output in Iran rose 57,000 bbl. daily to 638,000 bbl. daily, the highest since operations were renewed. This level was within easy reach of the best prenationalization months, and gave the country a 4.2 per cent share of total production.

Among the other major countries in the area, Kuwait produced 7.9 per cent of the world total; Saudi Arabia, 6.9 per cent; and Iraq, 5 per cent.

Among the smaller producing areas:

...In the Far East, output in Indonesia surged ahead with an increase of 22,400 bbl. daily in Caltex' Minas field in Central Sumatra. The field averaged 111,500 bbl. daily during the month, compared with 89,100 bbl. daily in September, and 68,000 bbl. daily a year ago.

...Some crude from Lirik field in Central Sumatra is being barged out by Standard-Vacuum Oil Co. Shipments rose to 1,400 bbl. daily from 600 bbl. daily in September after the rainy season raised the level of Indragiri River. This permitted bigger barge loads.

Output from the field will increase to 20,000 bbl. daily early in 1958 when an 88-mile, 8-in. heated pipeline is completed to Buatan terminal. The crude has a pourpoint of 105° F., but is especially suitable for catalytic cracking.

...Brazil's record high of 19,600 bbl. daily was attained when Petroleos Brasileiro, S.A. (Petrobras) increased output by 8,000 bbl. daily. This increase was made in Bahia fields, some of which had been shut in awaiting completion of field gathering and tanker loading facilities.

. . . Output in Trinidad also reached a new high of 84,100 bbl. daily. Production increases on the island generally have averaged a few hundred bbl. daily from month to month. The October increase of 3,900 bbl. daily was the largest single gain in recent years.

German Jobs Slated

$175-million Shell program includes big Bonn refinery

CONSTRUCTION of new facilities and expansion of old ones costing $175,000,000 is planned by Shell-Union in West Germany, all to be completed within the next 4 years.

Major item on the program is the building of an entirely new refinery adjacent to the petrochemical plant it now shares with Badische Soda near Bonn.

The refinery will have an initial capacity of between 55,000 and 60,000 bbl. per day and will cost approximately $70,000,000. It is due for completion late in 1960 or early in 1961. Ultimately it may have a capacity of close to 120,000 bbl. per day, which would make it one of the world's major refineries.

Another $75,000,000 will be spent on the existing Hamburg refinery to increase its capacity from 17,500 bbl. per day to 50,000 bbl. Work has already begun on this project and is expected to be completed next year.

Shell and Badische Soda will share the costs of a $35,000,000 expansion of their jointly owned petrochemical plant near Bonn. Principal product of this plant has been polyethylene. Its proximity to the new refinery will assure it of an ample supply of ethylene.

Stanolind Drills in Cuba

Cuban Stanolind Oil Co. has started its first drilling operations in Cuba and staked location for a second.

The Stanolind Oil & Gas Co. subsidiary was drilling at around 2,000 ft. early last week at Cuban Stanolind 1 Los Chivos, some 4 miles north of Alto Songo in Oriente Province. The second well will be Cuban Stanolind 1 Ermita on the Sierra de Canasta in the Guantanama area. Drilling is expected to start next month.

The tests are part of an exploration and drilling program covering about 15,000,000 acres, some of it offshore. Concession rights were included in an agreement between Cuban Stanolind, Trans-Cuba Oil Co., and the 24 companies managed by the Cuban Venezuelan Oil Voting Trust.

Qatar Storm Destroys Platform

THE drilling barge of Shell Co. of Qatar was wrecked late in December in a sudden storm in the Persian Gulf.

The 1,900-ton island virtually came apart at the seams in darkness after it was hit by wind and 20-ft. waves while being towed to a new location. The platform remained standing but it was doubtful last week whether it could be salvaged.

Two hundred fifty men were aboard the platform when crossbeams connecting the pontoons broke. The pontoons crashed into the drilling platform. Heavy equipment gave way and toppled into the gulf. Twenty Arabs were dead or missing following an early count after rescue operations.

The island had been located 50 miles offshore from Doha on the east coast of Qatar. The towing operation got under way at night after weather reports indicated suitable conditions. But a tempest came up unexpectedly.

The drilling barge originally cost Royal Dutch-Shell $1,400,000. After its first well was abandoned a year ago, an Ideal 100 rig replaced the original Ideal 50, and a helicopter port was added.

The 150-ft. by 87-ft. platform rested on eight 8-ft.-square legs. Normally the platform stood 40 ft. above water.

Venezuela Gets Price Hikes

CIA. SHELL DE VENEZUELA, effective December 29, added another 5 cents per barrel to the prices of some western Venezuela crudes and boosted some prices that were not affected by another increase which came earlier this month.

This announcement, the third by Shell within less than 2 months, followed an increase by Creole Petroleum Corp. of 4 to 13 cents in 11 Venezuela crude prices. Creole also announced a new scale of escalation for prices with regard to gravity variances.

The Jersey Standard affiliate said the new prices reflect increases in the price of No. 6 and other heavy fuels both in the Caribbean and in the United States.

The crudes increased by Creole are all heavier than 27° gravity. Crudes lighter than this dividing line remain unchanged.

New scale . . . The company said it believes its new scale of escalation more nearly reflects the value of changes in crude gravity and also pegged these changes to advances in heavy fuel-oil prices. In the future Creole will ask 2 cents per degree change, up or down, for crudes of 24° or lighter and 2½ cents per one-half degree change for all crudes heavier than 24° gravity.

The old escalation scale called for 2 cents per degree change for crudes of 30° gravity or lighter; 2½ cents per one-half degree for 20.0° to 29.9° gravity; and 3½ cents per one-half degree change for all crudes heavier than 20° gravity.

New postings . . . The new prices for the 11 crudes announced by Creole are: Tia Juana medium, up 10 cents to $2.40; Tia Juana low pour, up 10 cents to $2.72; La Rosa and Tigre, both up 11 cents to $2.36; Pedernales, up 4 cents to $2.09; Temblador, up 4 cents to $2.25; Motatan, up 6 cents to $2.02.

Tia Juana heavy, up 4 cents to $2.12; Quiriquire, up 5 cents to $2.40; Lagunillas heavy, up 13 cents to $2.33; and Bachaquero up 13 cents to $2.18.

Shell's new prices are: Leona, 24°-24.4°-gravity, f.o.b. Puerto La Cruz, $2.35; Cabimas, 22°-22.4°, Cardon, $2.30; Cabimas, 22°-22.4°, Cabimas Wharf, $2.22; Cabimas, 20°-20.4°, Las Piedras, $2.20; Temblador, 20.5°-20.9°, Caripito, $2.40; Taparito, 17°-17.4°, Las Piedras, $2.15; Bachaquero, 13.5°-13.9°, Las Piedras, $2.05; Bolivar District Heavy, 12.5°-12.9°, Cardon, $2; Bolivar District Heavy, 12.5°-12.9°, Cabimas or Bachaquero, $1.97; and Bolivar District Heavy, 12.5°-12.9°, Lagunillas, $1.92.

Richmond Exploration Co., Standard of California subsidiary, raised Boscan crude to $1.85 per barrel, f.o.b. Bajo Grande terminal.

Welsh Pipeline Considered

The British Parliament will consider a bill this session to permit British Petroleum Co., Ltd., to build a 60-mile, 100,000-bbl. daily pipeline from the Llandarcey refinery to a deep-water tanker terminal the company plans for Milford Haven in Wales.

The company estimates it will take 2 years to build the terminal and the pipeline, but work can't be started until government approval for the project is obtained. The pipeline capacity will easily exceed that of the 65,000-bbl. daily refinery.

Canal Work in Full Swing

Fleet of 30 salvage vessels will be at work by week's end; they should have Suez open to normal traffic in May

FULL-SCALE clearance of the Suez Canal started last week. Officials in charge predict the waterway will be ready for normal traffic in May.

Twenty-one craft were deployed at the northern end of the canal after Egyptian authorities gave permission for the all-out effort. Two vessels already had been working at the southern entrance.

By late this week the fleet of salvage vessels is expected to number 30. Ships from eight countries will be involved. All will fly the United Nations flag.

The green-light came after an 8-day delay following the withdrawal of British-French invasion forces from the country. Egyptian officials blamed the tie-up on mines in the channel, which they said were removed.

The timetable . . . Lt. Gen. Raymond A. Wheeler, head of the operation, anticipates 10,000-ton vessels will be able to navigate the canal by mid-March.

But few tankers of this size, or smaller, are engaged in the Middle East-Europe oil trade. So there will be little help for the transportation shortage at that time.

In the first stage of clearance, the goal is to remove sunken craft and two collapsed bridges from the 79-mile channel between Suez and El Cap.

In later stages, remaining obstructions will be cleared, workshops and power plants restored, and final removal of port obstructions and repair of port facilities will be made. This will be completed in May.

Europe limps along . . . Meanwhile, Europe was learning to live with the serious, although not desperate, oil shortage it faces this winter and spring.

In Britain, 380,000 bbl. of Kuwait crude were unloaded late in December from the 56,000-ton Sinclair Petrolore, the biggest tanker ever to dock in the country. The oil was delivered to the Fawley refinery of Esso Petroleum Co., Ltd.

The vessel had been rerouted while on its way to Philadelphia, via the cape, for delivery to Sinclair Oil Corp. In exchange for the Kuwait crude, Esso swapped oil from Venezuela.

United Kingdom imports, on the whole, declined 25 per cent in the first month of the squeeze. But the decrease was cushioned by stepped-up imports from the Western Hemisphere. On a dollar basis, November imports were valued at $67,000,000. This compared with an average of nearly $90,000,000 per month from January through October.

Many motorists in southwestern France are thumbing their noses at the gasoline shortage by converting to natural gas. A compressed gas cylinder is installed in the back of the car. Operation on gas per mile is reported to be about half the cost of gasoline, which covers the cost of installation fairly quick. Thousands of motorists are making the change.

Most French motorists, however, who are far from natural-gas supplies, were told to expect further cuts in gasoline supplies this month. Rations are to be reduced one-third to one-sixth for most car owners.

Eire is the latest country to limit motorists. Rationing went into effect January 1. In the Netherlands, refineries are running at 90 per cent capacity. A Sunday ban on driving is in effect. However, this is because 70 per cent of refinery output is exported.

West Germany is comparatively well off. Domestic crude fills about 30 per cent of its demand. A third of its normal supply from the Middle East comes from Tapline, the only uninterrupted source in the area. No rationing is anticipated. But there have been several price increases. The latest was a 5 to 7-cent per gallon boost in the price of high-quality lubricating oil.

Israel Pushes Line

Reports claim some crude to go to Western Europe

PROGRESS is reported well along on the construction of Israel's 8-in. pipeline from Elath to Beersheba, the halfway point to the Consolidated Refineries, Ltd. (Shell-British Petroleum) refinery at Haifa.

Four crews are reported to be working on the line, which is scheduled for completion in March or April.

Elath, at the head of the Bay of Aqaba, is 100 miles from the Red Sea. Beersheba, 125 miles directly north of Elath, is in the northern part of the arid Negeb wasteland. Haifa is another 110 airline miles north of Beersheba.

Source of the crude the line will purportedly carry and the means of getting it to Haifa have not been officially disclosed. Its purpose, however, is obvious: To eliminate Israel's dependence on the Suez Canal.

Pipe for the line is being made in Tel Aviv. Plans include unloading and storage facilities at Elath and storage facilities at Beersheba.

Suez bypass? . . . Rumors remain alive that Israeli interests are considering a line from Elath to Beersheba or beyond, then branching so that part of the crude would go to Haifa and the bulk to a Mediterranean port in southern Israel for shipment to Western Europe.

Companies Retrench

Middle East construction is shelved by production drop

COMPANIES in the Middle East are pulling in their horns on new expansion programs due to reduced crude production.

One firm, Arabian American Oil Co., expects to cut spending by $10,000,000 this year. This will be a 12 to 15 per cent reduction in planned capital expenditures, which last year were $80,000,000.

Aramco will save the money by postponing new building projects. Companies operating in other Persian Gulf countries are following suit.

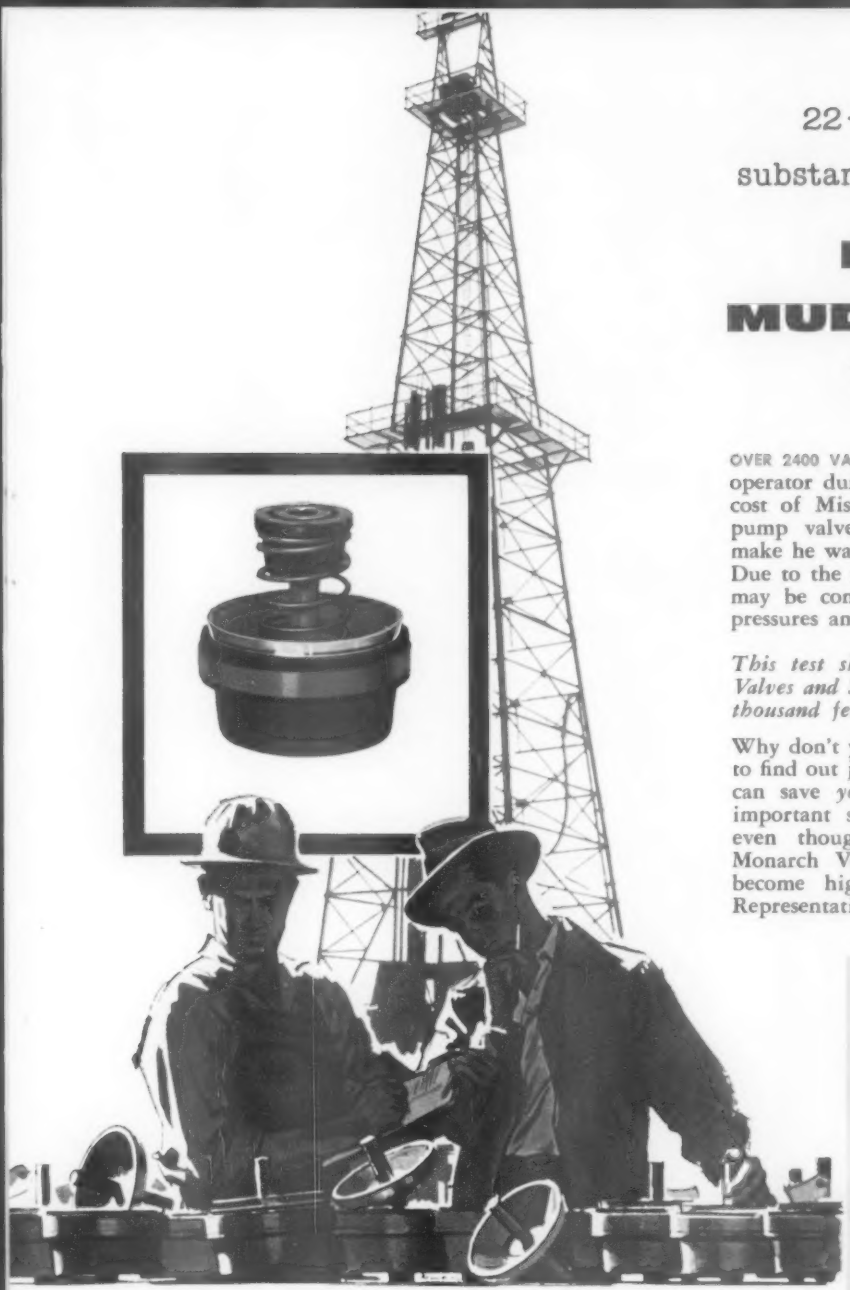
The deferment of expansion programs is temporary. Projects planned before the Suez crisis are still on the books. But they are expected to be put off 3 to 6 months or longer, depending on how soon the normal flow of crude is resumed.

The postponement of investments for further expansion is a direct result of lower income from a drop in crude sales. Pay rolls and other big fixed charges still must be met out of reduced income. The loss in revenue is being absorbed by deferment of new projects.

Exploration continues . . . In the case of Aramco, the company is trying to avoid layoffs. There will be no change in the 1957 exploration program.

Most of the deferment in expansion is expected to take place in countries with the sharpest drop in output. Iraq, where production fell 75 per cent after the disruption of pipeline service to the Mediterranean, will be most affected; Iran the least.

In addition to the postponed projects, there also are delays caused by the shipping slowdown from Europe and America to the Middle East.



22-month test showed substantial savings from using

MISSION MUD MONARCH VALVES

OVER 2400 VALVES AND SEATS were used by a large operator during a 22-month test comparing the cost of Mission Mud Monarch fluid end mud pump valves and seats with the competitive make he was using at the beginning of the test. Due to the size and duration of the test, results may be considered conclusive for the 2500-psi pressures and other conditions encountered.

This test showed that Mission Mud Monarch Valves and Seats cost less than half as much per thousand feet of hole as the competitive make.

Why don't you make a competitive test yourself to find out just *how much* Mud Monarch Valves can save *you?* Many operators have reported important savings at normal pump pressures, even though the advantage of using Mud Monarch Valves becomes greater as pressures become higher. Arrange with your Mission Representative for a competitive test.

COMPETITIVE VALVES

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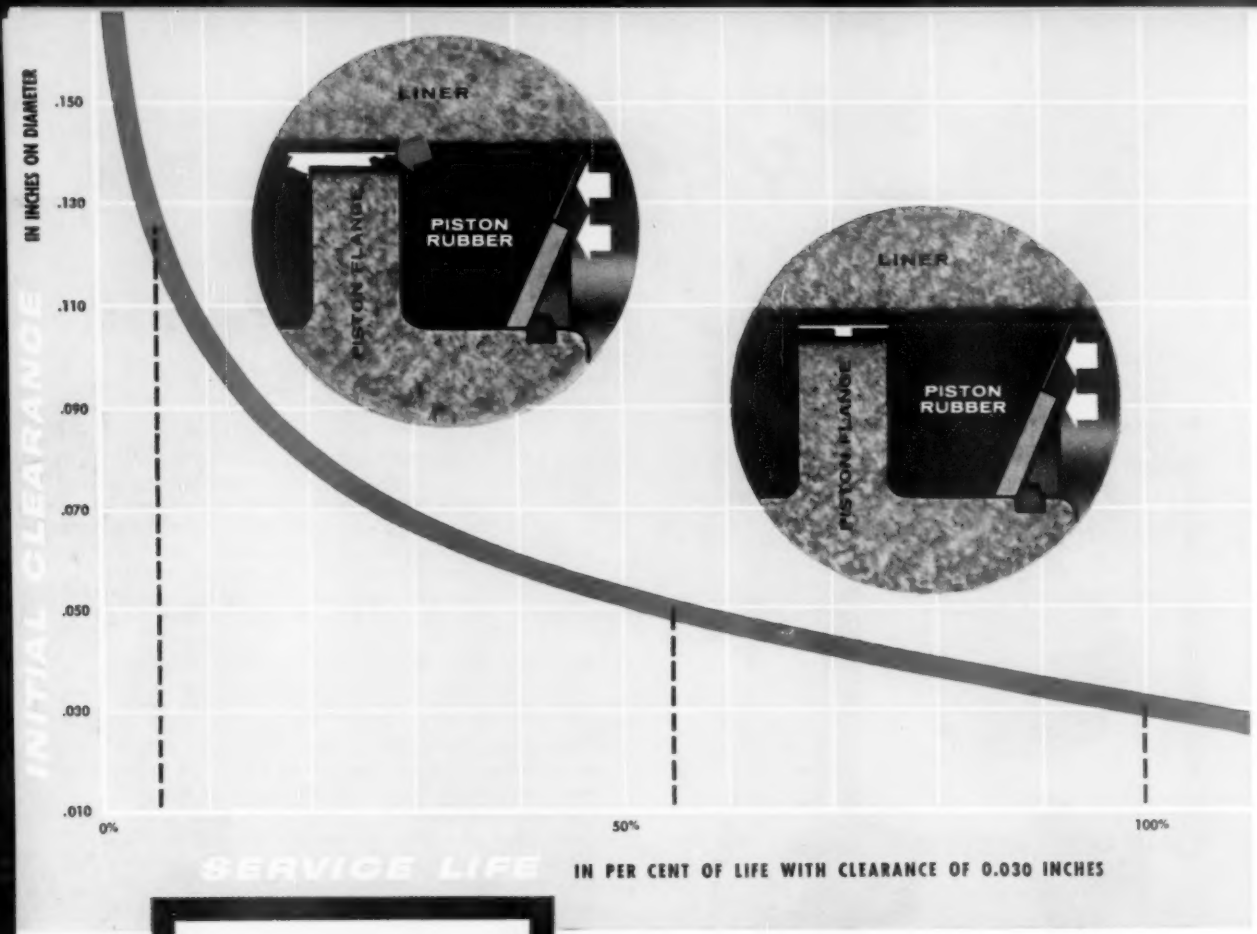

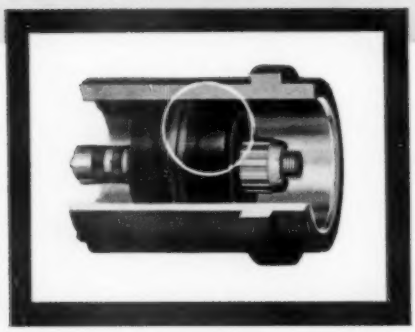

WHY YOU GET LONGER WEAR

.... from piston rubbers when Piston-Liner clearance is kept low!

THIS GRAPH IS AN ACTUAL RECORD of a series of tests run in the Mission Test Pumps. It shows just how much piston rubber life can be increased by replacing both liners and piston bodies before they are excessively worn.

For example, it was proved that piston rubber life could be increased *ten times* when initial clearance was reduced from 0.125 to 0.050. This ratio applies for the test conditions. The general principle applies in many cases—especially when pressures are high and operating conditions severe.

There is one important thing the chart does not show, however. You get closer clearances—*longer*—when you use *both* Mission Pistons and Mission Liners. Precision machining, together with advanced metallurgy and heat treating, accounts for this longer life.

Save both money and down-time by replacing pistons and liners before they are worn too much. When you do, you will make a further saving if you specify *MISSION* Pistons and *MISSION* Liners. They are available through supply stores everywhere.

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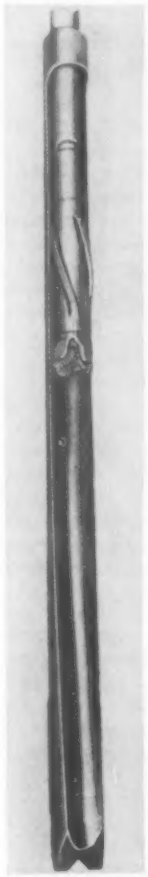


WHIPSTOCK, left, is used mostly for directional drilling, while KNUCKLE JOINT, right, is most useful for sidetracking a hole.

DRIFT INDICATOR is the only instrument normally employed during drilling down to the deflection point of directional wells. The disk, above, does not give hole direction.

SINGLE-SHOT SURVEY marks direction of hole and indicates drift angle. While hole is being deflected, surveys are made every 30 ft. They are made every 100 ft. after direction and angle are stabilized.

In Canada's Pembina and Joffre-Burbank fields

How 16 Wells Were Drilled Directionally

Inaccessible locations have necessitated considerable directional drilling in Canada. Profitable use of this technique depends highly on the skill and the attention of the operator. Important also is the use of directional surveys to determine the best way of hole deflection. Knowing how formation dip will affect hole deflection helps minimize directional drilling time and costs.

by
A. G. G. de Chastelain
Eastman Oil Well Survey Co., Ltd.

IN the last 12 months controlled directional drilling has been applied to the following cases in Canadian oil fields: (1) inaccessible locations; (2) hole straightening; (3) sidetracking a fish in the hole; (4) extinguishing a wild gas well via a directionally drilled relief well.

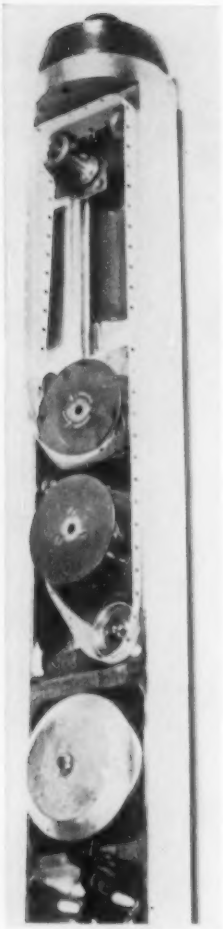
The inaccessible locations account for about 90 per cent of the total number of directional jobs done during the last year.

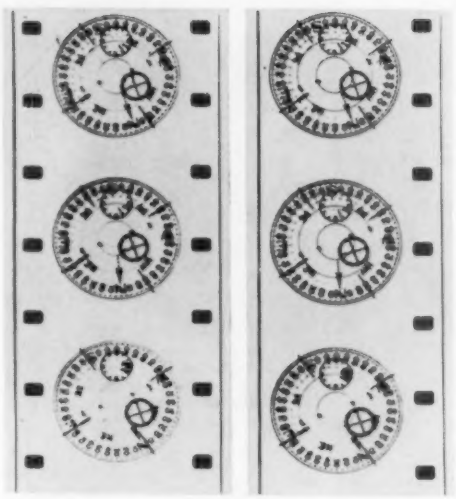
DRILLING

Pembina and Joffre-Burbank

This article presents data obtained from 16 wells drilled directionally—eight in Pembina field and eight in Joffre-Burbank field. Pembina is situated southwest of Edmonton and cov-

Article originally published by Canadian Oil and Gas Industries. It is a composite and condensation of papers presented at the 1956 general meeting of the Canadian Institute of Mining and Metallurgy at Quebec City and at the Calgary branch of C.I.M.





MULTISHOT SURVEY has camera which photographs a plumb bob in relation to a compass card. The film section, left, holds regular 16-mm. film, left above. Above, right, is 10-mm. film used with drop type that can be lowered down pipe into a nonmagnetic drill collar.

ers an area of about 700 sq. miles. Production is at present from the Cardium zone at an average depth of approximately 5,000 ft. Joffre-Burbank field is situated roughly midway between Edmonton and Calgary to the east of the highway. Production is from the Viking sand. Pembina field is traversed by the North Saskatchewan and Pembina rivers and contains large areas of muskeg while Joffre-Burbank field presents directional problems mainly due to the Red Deer River.

Table 1 shows the principal technical data of these 16 directionally drilled wells together with the time and cost estimates alongside the actual time taken and actual cost.

Making estimates . . . Combining the results of Pembina with those of Joffre, the estimates were 10 per cent out in terms of time and 11 per cent out in terms of cost. This margin of 10 per cent is not unreasonable when all relevant circumstances are taken into consideration.

Estimates of cost of partly drilling a well under directional control are prepared in the majority of cases, before the well is spudded. Consequently it has to be assumed that at the point of deflection the hole is vertical.

In practice this condition seldom occurs and while it is less important in cases where there is ample footage to be drilled under control, it can give rise to serious problems when deflection has begun within a relatively short distance of bottom.

Drift and Direction at Point of Deflection

To illustrate this point, Table 2 shows, in the case of each well under consideration, the direction of the hole at the point of deflection, the drift of the hole away from vertical at that point, the desired direction, the change of direction necessary, and the final direction of the hole on completion. In only 1 case in 16 was the hole running vertically. The changes of direction varied from 20° to as much as 170°.

The essence of good directional drilling is to connect the original point of deflection with the entry of the hole into the producing horizon along the least tortuous path. The object is to minimize difficulty in the running in and out of the drilling string, permit easy running of casing, and eventually lessen wear on the tubing during production.

This particular point is mentioned here not to excuse but to explain one of the principal reasons why actual times are occassionally in excess of those estimated. It will, of course, be observed that in some cases the time taken was less than that estimated.

Wrong drift . . . If the hole at deflec-

TABLE 1—COST OF DIRECTIONALLY DRILLED WELLS

(a) Pembina

Well number	1	2	3	4	5	6	7	8
Controlled footage	4,137	3,975	1,010	985	5,155	1,250	1,197	1,490
Deviation in feet	1,512	1,558	205	218	1,905	162	267	280
Maximum angle	31°	32°30′	15°	20°15′	34°	14°30′	20°15′	14°30′
Comparison between true and estimated time and cost								
Estimated days	21	21	8	9	21	9	7	9
Days taken	20.5	14	9	10	31	11	13	8
Estimated cost,* $	5,560	5,510	2,780	2,800	5,510	2,550	2,150	2,350
True cost,* $	5,480	4,350	3,080	3,060	7,680	4,890	4,160	2,440

*To nearest $10.00.

Summary:	Cost	No. of days
Estimated	$29,210.11	105
True	$35,150.91	116.5
Difference	$5,940.20	+11.5

(b) Joffre-Burbank

Well number	1	2	3	4	5	6	7	8
Controlled footage	1,760	3,352	1,934	3,852	2,864	1,164	3,891	2,970
Deviation in feet	544	1,294	593	1,220	1,020	177	1,417	1,287
Maximum angle	30°30′	31°	28°	27°	32°	12°30′	27°30′	33°30′
Comparison between true and estimated time and cost								
Estimated days	12	16	12	15	15	9	18	11
Days taken	24	20	11	18	13	9	12	12
Estimated cost,* $	3,350	4,540	3,410	3,920	4,390	3,060	5,120	3,520
True cost,* $	5,590	4,880	3,310	4,790	3,790	2,970	3,600	3,880

*To nearest $10.00.

Summary:	Cost	No. of days
Estimated	$31,314.54	108
True	$32,804.30	119
Difference	$1,489.77	11

tion point is vertical or already going in the desired direction, there is no problem. If, however, as often happens, the hole is drifting the wrong way, its direction can be changed in one move and may require the setting of several deflecting tools in order to reach the right direction without the formation of an undesirable dog leg which might cause trouble during subsequent drilling operations and during production.

If drift and direction are right at the first whipstocking point, it is often possible to complete the job with one whipstock. This is where the experience of the operator and his "feel" for the job comes into play. The single-shot picture taken after the first run with the bit after reaming the rat hole will indicate the tendency of the hole to turn left or right and to gain or lose drift angle.

Doesn't depend on bit . . . In our experience, neither cross-section nor tricone bits have a right or left-hand tendency in directional work. The main cause of right or left-hand turn is the angle between the course along which the hole is forced to go and the dip of the formation.

For example: If proposed direction is due updip, there will be no directional difficulties and drift angle can be built readily; if proposed direction is left of updip, the result will be a tendency to turn to the right; likewise if proposed direction is right of updip, the tendency will be to turn to the left; if proposed direction is exactly with the strike, there will be no directional or drift-angle difficulty.

Demands on operator . . . In directional drilling perhaps more than in any other drilling operation in an oil well, the ability and even the character of the individual operator can be reflected in performance figures. Directional drilling makes a continuous demand upon the attention and thought of the operator and when this is forthcoming it not infrequently happens that wells are drilled more quickly under directional control than by normal methods.

The experience of the operator combined with his constant attention to what is happening in the hole, are the factors which determine not only how quickly the job will be done but also how well it will be done. This means the absence throughout the controlled portion, of dog legs which can produce key-seating problems during drilling and to other problems during the productive phase.

Table 3 lists the changes of drilling hookup employed on each of the wells under review together with the footage drilled in each case for every change of hookup. This last figure is considerably more consistent in the case of Joffre than in Pembina. Wells No. 2 and No. 5 in Pembina were drilled by the same operator and while in one case he obtained the highest footage per hookup, on the well with the longest controlled footage the feet per hookup was a low 86.

The greater consistency of the results obtained in Joffre-Burbank can be explained in part by the fact that these wells were drilled at close intervals of time and consequently the operators had either information or personal experience readily available from a previous well as a guide.

All of the Joffre-Burbank wells were drilled between the end of November 1955 and mid-February 1956 in relatively severe winter conditions when over-all efficiency both of men and of equipment was not at its highest.

TABLE 3—CHANGES OF DRILLING HOOKUP FOR DIRECTIONAL WELLS

(a) Pembina

Wells No.	Changes of hookup	Controlled footage	Footage drilled per hookup	Deflecting tools
1	22	4,137	188	2
2	18	3,975	220	1
3	10	1,010	101	2
4	11	985	89	2
5	60	5,155	86	8
6	19	1,250	66	3
7	19	1,197	63	4
8	11	1,490	135	2

(b) Joffre-Burbank

1	32	1,760	55	5
2	32	3,352	104	5
3	16	1,934	121	1
4	32	3,852	120	1
5	21	2,864	136	3
6	9	1,164	129	1
7	19	3,891	205	2
8	15	2,970	198	2

TABLE 4—BREAKDOWN OF TIME ON DIRECTIONALLY DRILLED WELLS

(Percentage of total time)

	Pembina	Joffre	Combined
Drilling	53.4	51.0	52.0
Surveying	7.8	7.8	7.8
Tripping	25.5	21.5	23.4
Rig repair	0.8	10.0	5.5
Rig service	2.4	1.7	2.1
Reaming	4.3	4.0	4.2
Circulating and mud conditioning	4.3	4.0	4.3
Miscellaneous	1.5	0	0.7
Total	100.0	100.0	100.0

TABLE 2—CHANGE OF DIRECTION OF DEFLECTED WELLS

(a) Pembina

Well No.	Desired direction	Drift and direction at deflection point		Final direction	Change of direction*
1	S 46° W	0° 15′	N 10° W	S 46° W	124°
2	S 37° 32′ E	0° 30′	S 45° W	S 37° 32′ E	83°
3	S	0° 15′	S 33° E	S 29° E	33°
4	E	1°	N 49° W	E	139°
5	N 56° W	0° 30′	S 80° W	N 55° 35′ W	44°
6	E	0° 45′	N 17° W	N 89° 17′ E	107°
7	S	0° 45′	S 84° W	S 1° 27′ E	84°
8	N 75° 15′ E	0° 30′	S 65° W	N 74° 30′ E	170°

(b) Joffre-Burbank

1	S 85° W	1° 15′	N 66° E	S 82° W	161°
2	W	0° 30′	N 34° W	N 79° 28′ W	56°
3	S 70° W	3° 0′	S 15° W	S 73° 18′ W	55°
4	N	0° 15′	N 20° W	N 13° 48′ E	20°
5	S	1° 15′	N 85° E	S 5° 39′ W	95°
6	N 48° E	0°	0°	N 46° 38′ E	0°
7	S 50° W	0° 30′	N 45° E	S 51° 29′ W	174°
8	N 89° W	0° 45′	N 46° E	S 80° 53′ W	146°

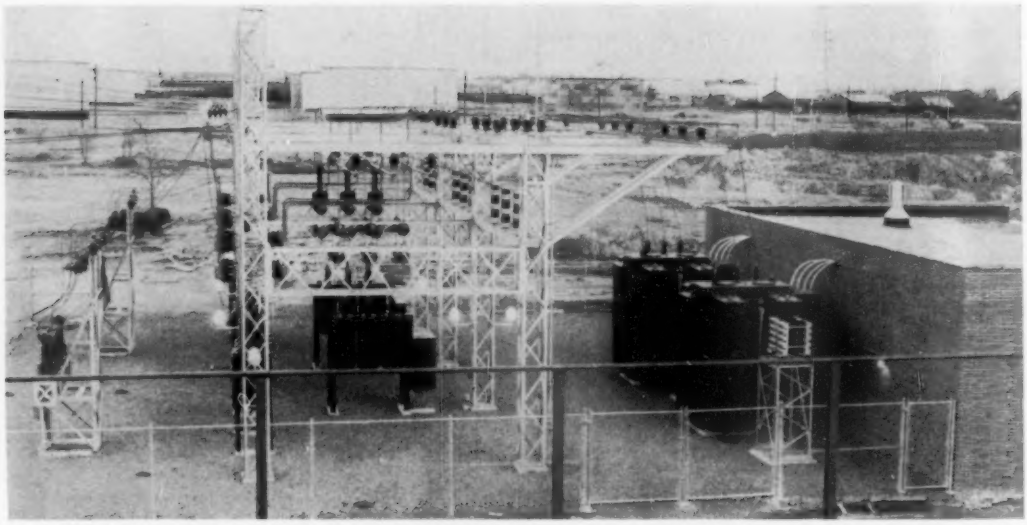
*To nearest 1°.

Breakdown of Time

As in all drilling operations, efficiency is dependent in the first place upon the number of hours out of 24 during which the bit is actually drilling on bottom. Due to the need for frequent surveying and for more frequent tripping than is necessary in straight-hole drilling, directional drilling would appear to be at a disadvantage. However, as mentioned earlier, the constant attention and control which go along with the directional-drilling technique should compensate for this disadvantage.

In the case of Pembina, the percentage of total time spent in drilling varied from a low of 47.7 per cent on well No. 5 to a high 63 per cent on well No. 1. Curiously enough, these two wells were drilled by the same operator. The average in Pembina is 53.4 per cent. In the case of Joffre-Burbank the range is from 35.5 per cent (well No. 1 with 117 hours rig repairs) to 61.6 per cent with an average of 51.0 per cent.

Table 4 gives a comparison between the breakdown of time in the two fields expressed as a percentage of the total. It will be observed that the two tables are very close, the only significant difference occurring in rig repairs, entirely due to well No. 1 in Joffre-Burbank. **End.**



PACKAGE SUBSTATION incorporating outdoor high-voltage components serving indoor medium-voltage switchgear within the building. Fig. 1.

In refineries . . .

Switchgear's Getting Safer

by D. S. Brereton and

STANDARD low-voltage switchgear in a petroleum plant. Fig. 3.

STANDARD switchgear, both indoor and outdoor, can be made an almost universal tool in the electrical power system for refineries. In average refinery installations it can be installed as close as 50 ft. to the source of potential hazard in freely ventilated process areas.

If the switchgear is installed in a pressurized building of proper design, it may be installed as close as 25 ft. from the source of potential hazard in a freely ventilated area.

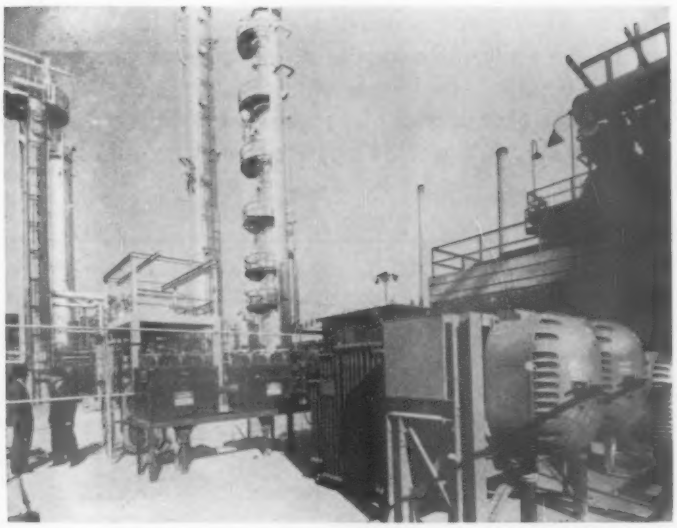
One of the important influences in the application of electrical equipment is the recent "A.P.I. Recommended Practice for Classification of Areas for Electrical Installations in Petroleum Refineries."[1] The increased general acceptance of this recommended practice[2 3 4] which now more clearly distinguishes between a Class I, Division 1 and Division 2 area of the process facility, also defines the area that is free from the hazard.

Influence on switchgear . . . RP-500 clearly discusses the factors that should be considered in classifying areas and also provides a very understandable procedure for determining the proper classification of an area. Finally, by means of simple, clearly dimensioned diagrams, it provides a method for establishing the extent of a classified area. If RP-500 is recognized by all parties involved, the refiner, consulting engineer, and contractor, a solid basis on which to select and design the electrical equipment is obtained.

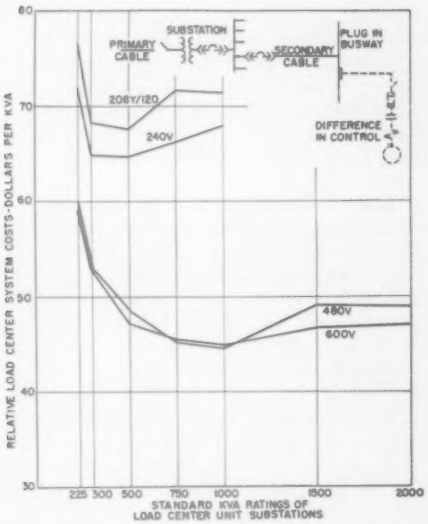
The most significant contribution of RP-500 is that it clearly dimensions the extent of the hazardous areas (Class I, Division 1 and Division 2). By close examination, it can be concluded that for the average refinery installations, standard switchgear can be installed as close as 50 ft. from the source of potential hazard in freely ventilated process areas, or 10 ft. outside of building structures containing a source of hazard where the air ventilation is restricted in the building.

This switchgear could be either the outdoor type on a 2-ft.-high foundation (where exposure to heavier-than-air gases is possible), or the indoor type in a suitable building. Standard switchgear could even be located in freely ventilated areas as close as 25 ft. from the source of hazard, if installed in a pressurized building using a stack reaching at least 25 ft. above ground level. It is evident that these small distances between switchgear and load cannot be considered a disadvantage.

Authors are with General Electric Co., Schenectady, N. Y. Paper presented at Petroleum Electrical Conference, A.I.E.E., Kansas City.



OUTDOOR low-voltage explosionproof switchgear in a hazardous area. Fig. 2.



INSTALLED COST of load-center unit substations and systems. Fig. 4.

All the Time

J. Dunki-Jacobs

A multiple of sources of hazard might well result in a considerably larger area that should be considered hazardous. However, medium-voltage feeders of 500-ft. length are not uncommon in industrial areas. This indicates that even multiple sources of hazard will not prevent the installation of standard equipment. The relative location of the multiple sources of hazard, on the other hand, might make certain areas between hazardous locations nonhazardous above 25 ft.

In such cases, again, standard switchgear could be used if installed in a pressurized building. Especially in modern refineries, where the process units are scattered over a wide area, advantage can be obtained from the local nonhazardous areas that are existing 25 ft. above ground level.

Application of Switchgear

Standard switchgear, serving loads in buildings having restricted ventilation, could very easily be installed 10 ft. outside the building foundations as recommended by RP-500. Since building dimensions, although sometimes appreciable, are always limited, the load will be well within the reach of this switchgear. However, some refiners sometimes prefer the controlling apparatus to be closer to the load than is possible by using standard switchgear. In these cases, explosionproof equipment should be used.

The influence of A.P.I.'s RP-500 is particularly evident in the application of medium-voltage switchgear. The use of Class I, Division 2 type of switchgear is unusual in refinery applications. The added cost and difficulty of maintaining Class I, Division 2 type of switchgear has discouraged its use. Further, standard switchgear has the ability to accommodate a larger number of protective relays and devices.

Maintenance of standard indoor switchgear as against outdoor equipment is in favor of the indoor type. Many economic studies reveal that the installed cost of indoor equipment and a building is less than that of outdoor equipment.

A recent application of medium-voltage switchgear is shown in Fig. 1. This example of a package substation shows the high-voltage service, primary breaker, and transformation to the indoor medium-voltage switchgear within the building. This particular plant distributes power at 4.16 kv.

Trends . . . The trend is to apply medium-voltage switchgear in nonhazardous areas, either as an outdoor equipment or as standard indoor equipment in a building (with a preference for the latter).

The selection of low-voltage switchgear equipment is principally a function of the necessity of locating the equipment close to the electrical load it controls. In nonhazardous areas, both outdoor and indoor, equipments are being applied with some tendency toward indoor equipment, particularly in areas that experience more severe weather. In hazardous areas, in contrast to the medium-voltage switchgear, the application of components in explosionproof housings is common.

Fig. 2 is an example of an outdoor explosionproof unit substation, and Fig. 3 shows the application of standard indoor switchgear.

When low-voltage switchgear is applied in hazardous areas, there is a tendency to use standard indoor equipment in a pressurized building, **provided** the building is infrequently occupied. If the building also contains process instrumentation which require operators, explosionproof switchgear is the common application because of the difficulty of keeping the building pressurized.

Selection of substations . . . A check was made of available information to observe the most common ratings of

480-volt load-center unit substations in the petroleum industry. During 1955 and the first quarter of 1956, approximately 10 per cent of the substations were rated 500 kva., 35 per cent were rated 750 kva., 25 per cent were rated 1,000 kva., and 20 per cent were rated 1,500 kva.

A recent study of the application of load-center unit substations for general industry use has indicated that the 750 and 1,000-kva. 480-volt load centers are preferred. The results of this study are indicated in Fig. 4. The approximate first cost of a load-center unit substation, in dollars per kva., is shown in Fig. 5.

It is interesting to observe that the ratio of the use of 480-volt power, as compared to 208-volt power, is increasing for the general industry application, due to the increased use of higher-voltage fluorescent lighting. This experience has not been observed in the petroleum industry due to the wide application of incandescent lighting. As a matter of interest, the commercial building field is saving between $20 and $30 per kva. in applying higher-voltage lighting from a 480Y/277-volt system.

Switchgear preference . . . In the survey of the petroleum industry, a request was made to indicate the reason for the preference of the type of switchgear that had been applied for loads located in hazardous areas.

As indicated in the sample survey, these reasons could have been based on either one or more of the following considerations:

(1) Location of power source as close to load as possible, (2) use general-purpose standard equipment (not explosionproof), (3) company policy, (4) economics (compared installations of the same voltage ratings), (5) easier maintenance, (6) greater safety, and (7) no other suitable nonhazardous location near load was available.

As for the application of standard indoor switchgear, the underlying reasons, in the order of their preference, are as follows:

1. Economics.
2. Uses general-purpose, standard equipment.
3. Company policy.
4. Greater safety.

An increased emphasis is being placed on the economics, considering installed cost instead of first cost, of switchgear equipments.

Power to Operate Electrically Operated Breakers

Four selections are included in the survey concerning the method of operating electrical breakers. They are:

". . . Use of 480-volt power, as compared to 208-volt power, is increasing for general industry application, due to increased use of higher-voltage fluorescent lighting. This experience has not been observed in the petroleum industry due to the wide application of incandescent lighting."

APPENDIX A

A.I.E.E. COMMITTEE ON PETROLEUM INDUSTRY

"TRENDS IN SWITCHGEAR APPLICATIONS FOR REFINERIES"

Survey of Actual Installations

The principal purpose of this survey is to determine the reasons why either indoor or outdoor switchgear equipments are installed in either hazardous or nonhazardous locations.

Please use a separate copy of form to describe each type of switchgear.

Prepare a copy of this survey for <u>each</u> type of switchgear, installed in one refinery.

Please complete one-line diagram on back.

Customer _____

Name of refinery _____

Location of plant _____

1. Year of installation: 19__
2. Switchgear voltage:
3. Is location of switchgear considered to be: _____
4. Type of switchgear: _____
5. Is location of load considered to be (hazardous) (nonhazardous) cross out one
6. What was the reason for preference of this type of switchgear: (Check reason by number) _____
   a. Location power source as close to load as possible _____
   b. Uses general-purpose standard equipment (not explosion-proof) _____
   c. Company policy _____
   d. Economics (compare installations of same voltage ratings) _____
   e. Easier maintenance _____
   f. Greater safety _____
   g. No other suitable nonhazardous location near load was available _____
7. Estimate the installed cost of this type of switchgear:
   1. Cost of switchgear in $/kva. _____
   2. Cost of building in $/kva. _____
   3. Type of building (i.e., wood, concrete, cinder blocks) _____
   4. Dimension of building _____
8. Power to operate electrically operated breakers
   A. Batteries: close and trip _____
   B. Rectifier close, battery trip _____
   C. A.c. motor close, direct trip _____
   D. Others _____
9. Provisions to warn operating personnel of loss of air pressure in building: Yes _____ No _____
10. Have you built a roof over the switchgear to shelter operating and maintenance personnel during snow or rain: Yes _____ No _____
11. Have combustilbe mixtures ever been detected around switchgear during normal plant operation: Yes _____ No _____
12. Has explosion proofing always been restored after maintenance, requiring opening of housing: Yes _____ No _____
13. Other factors being equal, what is presently preferred:
    a. On medium-voltage switchgear _____
    b. On low-voltage switchgear _____

Total number of each switchgear type in refinery and number of breakers _____

(Continued on next page)

APPENDIX A (Continued)

☐ Medium Voltage ... Kv			☐ Low Voltage ... Volts			
Hazardous ☐	Nonhazardous ☐		Hazardous ☐		Nonhazardous ☐	
Indoor Switchgear in Pressurized Building	Indoor Switch-gear	Outdoor Switch-gear	Indoor Switchgear in Pressurized Building	Components in Explosion	Outdoor Switch-gear	Indoor Switch-gear
☐	☐	☐	☐	☐	☐	☐
☐			☐	☐		
☐	☐	☐	☐			☐
☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐
☐			☐	☐		
☐ $	☐ $	$	☐ $	☐ $	☐ $	☐ $
☐ $	☐ $		☐ $			☐ $
☐ $	☐ $		☐ $			☐ $
☐ X X	☐ X X		☐ X X			☐ X X

One-line diagram of switchgear equipment. Please include:

1. Incoming line(s): voltage
2. Power transformer(s): Kva. rating, single or three-phase, connections, voltage ratings
3. Feeder breaker(s) type: manual, automatic
4. Tie breaker(s): normally open or closed, manual or electrical, automatic
5. Nature of load: motors, transformers, others
6. Length of feeders: approximate distance between switchgear and load.

(1) batteries: close and trip; (2) rectifier close, battery trip; (3) a.c. motor close, direct trip; and (4) other.

The general trend for medium-voltage equipment is to use a battery for both close and trip power, with some use of rectifier close and battery trip for outdoor switchgear.

Manual breakers, for low-voltage services, seemed to be the most common application. When electrical operation is required, an a.c. control power transformer is the most common source, although a d.c. tripping battery is frequently applied.

The reliable d.c. control voltage, as always has been, is still preferred for closing and tripping of medium-voltage breakers. For low-voltage breakers, except for some specific applications, manually operated breakers are in general use.

Trends in System Protection

Electric motors that are exposed to lightning, if not operated in Division 1 or Division 2 areas, can easily be protected by surge capacitors and lightning arrestors.[5] Because this surge protective equipment is not accepted for application in hazardous areas, it is customarily not applied directly at the motor terminals. Investigations have revealed that if surge protective equipment is applied on the load side of a circuit breaker serving a motor, substantial benefits can be obtained in many cases.

There is some increase in the application of surge protective equipment for motors in hazardous areas.

System neutral grounding . . . System neutral grounding is now being more widely applied in the petroleum industry. Actual investigations of transient overvoltages due to repetitive restrike and other causes have been made.[6] Transient analyzer studies have revealed the characteristics of operating a high-resistance[7,8] grounded system.

When a ground fault occurs and tripping of a feeder breaker is desired, solid grounding is used for low-voltage systems and low resistance grounding is applied for medium-voltage systems. When tripping is not desired on the first ground fault, high resistance grounding is applied to both low and medium-voltage systems.

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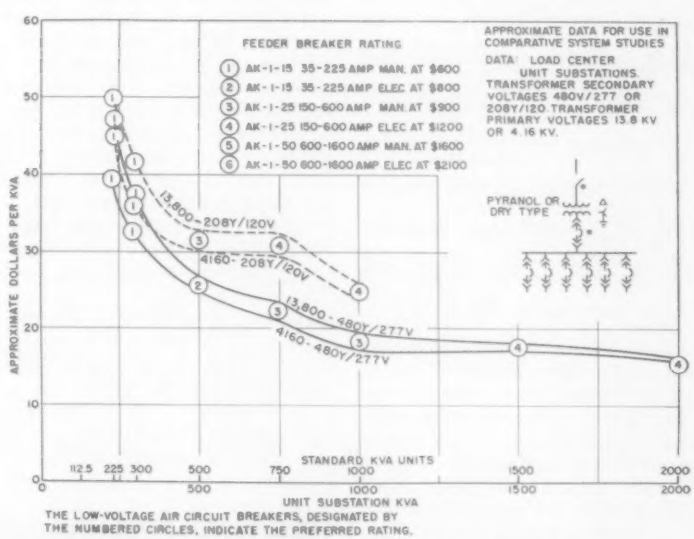
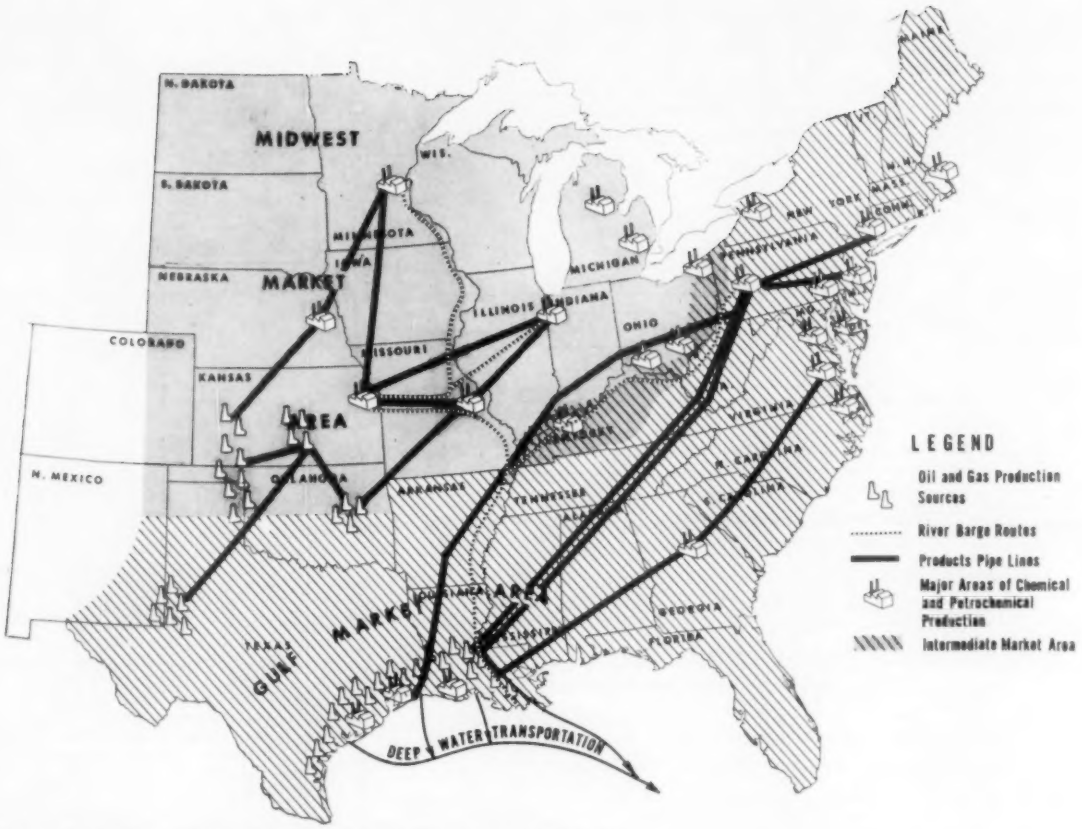

FEEDER BREAKER RATING
1 AK-1-15 35-225 AMP MAN. AT $600
2 AK-1-15 35-225 AMP ELEC AT $800
3 AK-1-25 150-600 AMP MAN AT $900
4 AK-1-25 150-600 AMP ELEC AT $1200
5 AK-1-50 600-1600 AMP MAN. AT $1600
6 AK-1-50 600-1600 AMP ELEC AT $2100
APPROXIMATE DATA FOR USE IN COMPARATIVE SYSTEM STUDIES
DATA: LOAD CENTER UNIT SUBSTATIONS. TRANSFORMER SECONDARY VOLTAGES 480Y/277 OR 208Y/120. TRANSFORMER PRIMARY VOLTAGES 13.8 KV OR 4.16 KV.
PYRANOL OR DRY TYPE
13,800-208Y/120V
4160-208Y/120V
13,800-480Y/277V
4160-480Y/277V
APPROXIMATE DOLLARS PER KVA
STANDARD KVA UNITS
112.5 225 300 500 750 1000 1500 2000
UNIT SUBSTATION KVA
500 1000 1500 2000
THE LOW-VOLTAGE AIR CIRCUIT BREAKERS, DESIGNATED BY THE NUMBERED CIRCLES, INDICATE THE PREFERRED RATING.

FIRST COST, approximate, of a load-center unit substation. Fig. 5.



FUTURE PETROCHEMICAL PIPELINES could make possible market advantages in shaded area for plants based on Oklahoma and Kansas production sources. Fig. 1.

Petrochemical Pipelines May Bring

Natural advantages assure the Gulf Coast's leadership in petrochemical production. But there may be a multimillion-dollar plum waiting for Kansas and Oklahoma plants which would tap Midwest market with chemicals shipped through products lines.

COULD the pipeline movement of petrochemicals divert the location of some future plants from the Gulf Coast to the Midwest?

It's possible, according to a study by the Midwest Research Institute, of Kansas City. William T. Kopp, Midwest Research economist, looked into the plant prospects for Kansas and Oklahoma in particular, with petrochemical products pipelines as the key.

His conclusion was that there's no chance of shifting the center of gravity from the Texas-Louisiana area, with its cheap water transportation and other natural advantages. But Kopp does believe that the Kansas-Oklahoma producing and refining area has the potential for at least 50 to 75 million dollars in additional petrochemical investment. And the total could "approach 300 million dollars if the full potential of the industry is realized. . . ."

Investment possibilities . . . Kansas and Oklahoma, according to Kopp's study, could support the following additional petrochemical investment:

. . . Aromatics (with heavy emphasis on benzene)—$25,000,000.

. . . Natural gasoline plants — $10,000,000.

. . . Ethylene—$10,000,000.

. . . Alcohol—$5,000,000.

This would amount to $50,000,000. In addition, the study mentions "a strong potential" for allied products which aren't related to movement by products lines. Here are the estimates, totaling $23,000,000.

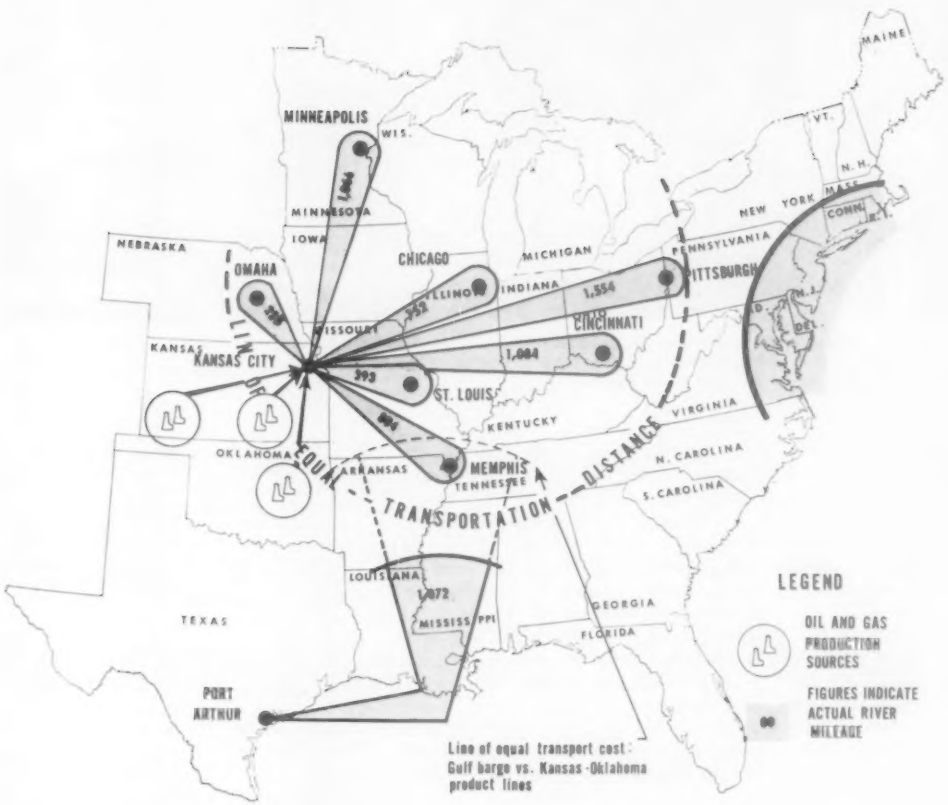
. . . Cresylic acid—$1,000,000.

. . . Naphthalene—$5,000,000.

. . . Polyethylene—$12,000,000.

. . . Ethylene glycol—$5,000,000.

And these are only the short-range possibilities, in Kopp's opinion. These sums, of course, would cause scarcely a ripple in the over-all picture, and would be missed but little along the Gulf Coast's petrochemical row, however important they might be to the inland states. The preliminary study on which they are based considers only the single factor of transportation. It does not take into account the mild weather permitting open construction, abundant water supply or other points which, besides its proximity to the na-



FIGURES show barge route distances to chemical markets, calculated from Kansas City and the Houston-Port Arthur area. Fig. 2.

Plants to Midwest

tion's largest producing and refining areas, has made the Gulf Coast a petrochemical manufacturing center.

Domination of the industry by the Gulf Coast will increase sharply by 1960, Kopp observes, if present trends continue. Investment which could be supported in the Midwest will be drawn to the Gulf Coast, which has access to deep-water transportation to eastern chemical markets as well as to barge movement up the Mississippi, Ohio, and Illinois rivers.

The problem . . . However, these facts do not mean that inland states can't attain a significant share of the petrochemical business, Kopp states.

"In fact," he says, "the natural-gasoline plants and oil refineries have sufficient production in the Kansas-Oklahoma area to permit large-scale production of a number of first and second-tier petrochemicals if the cost of transportation is such that a volume market could be reached."

How to accomplish this is the subject of the report.

Tank-truck and railroad tank-car shipments are dismissed as too costly to fit into the picture, leaving products pipelines and barge shipments to offset coastal advantages. Kopp outlines a market area in which he says Kansas, Oklahoma, and North Texas chemical and petrochemical plants could compete using barge and products pipeline movement (Fig. 1).

Petrochemical pipelines . . . The Midwest Research Institute study points out that piping of petrochemicals now is limited to short hauls, mainly between producing plants in the same area. Distances are seldom greater than 50 miles.

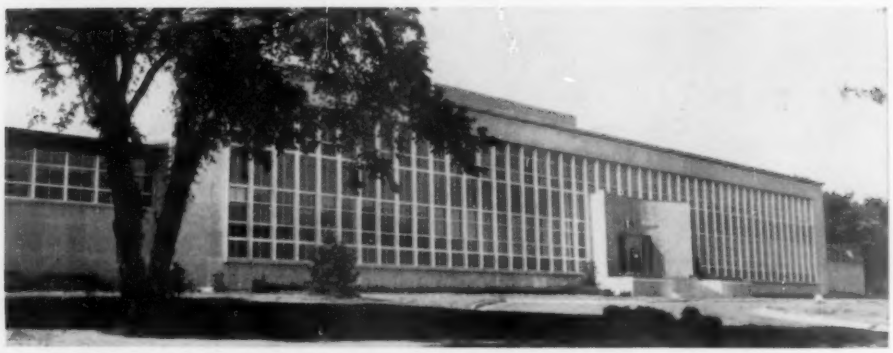
These short lines now move ethylene, caustic soda, certain acids, brine, liquid chlorine, styrene, butadiene, and other products.

"In most instances," Kopp declares, "there is no insurmountable handicap or technical drawback that cannot be overcome in volume shipment of first, second, and third-tier petrochemical and chemicals by products pipelines. It's conceded that "only specifically designed and chosen petrochemicals can be shipped."

Other candidates for pipeline shipment are listed as benzene, xylene, and toluene. Also there is some "technical and economic chance" for piping ethylene, chlorinated products, methanol, styrene, butadiene, dodecyl benzene, propylene tetramer, ethylene glycol, and formaldehyde.

Midwest markets . . . Kansas and Oklahoma plants could have a competitive marketing advantage in an area from below Cairo, Ill., along a line to Pittsburgh, paralleling the Ohio River 50 to 100 miles to the north of the river.

This statement is based on Kopp's comparison of per ton costs of barge transportation up the Mississippi from Port Arthur and Houston vs. per ton



William T. Kopp, who conducted market study at Midwest Research Institute (above), believes that with utilization of products lines for petrochemicals, the Kansas-Oklahoma area could take over part of the market now served by Gulf Coast plants.

costs of pipeline shipment from the Wichita-Tulsa area (Fig. 2). This would open the St. Louis, Minneapolis, Chicago, Detroit, Toledo, and Youngstown chemical markets to Kansas-Oklahoma plants. Pittsburgh and Buffalo might also be reached, at least partially, by products lines, Kopp believes.

He places Ohio River ports of Cincinnati, Paducah, Ky., and Moundsville, W. Va., into the "partial range" of the Kansas-Oklahoma area if barge transportation is utilized from Kansas City to St. Louis, then up the Mississippi and Ohio rivers.

"Thus, by the use of barge transportation, chemical shipments from Kansas City could actively compete with the Gulf Coast products along the entire Ohio River barge route."

Competitive costs were computed on a basis of 3 mills per ton-mile per thousand miles for barges and 4.7 mills per ton-mile per 500 miles of products pipeline.

Kopp estimates that about one-third of the total chemical-process industry is within the Midwest market area.

Benzene possibilities . . . As an example of the market potential, two GR-S rubber plants in Akron are cited.

Benzene requirements for these 30,000-ton per year plants total 80,000 to 90,000 bbl. "This is well within the range of product pipeline volume requirements, since the minimum unit transmission volume is only 5,000-10,000 bbl.," Kopp states.

Previous studies by the research institute indicate that 250,000 to 275,000 bbl. of benzene per year can be shipped from the Kansas-Oklahoma area, above and beyond requirements for upgrading gasoline. This is based on possible addition of the required benzene production facilities in relation to the projected expansion of reforming capacity.

General prospects . . . In what he calls a "rough estimate of the petrochemical market advantages within reach of the Midwest area," Kopp comes to these tentative conclusions:

. . . Kansas City's prospects for developing a petrochemical-process industry, based on Kansas-Oklahoma material sources, should be enhanced by extensive utilization of barges. This would make possible smaller unit shipments of products from Kansas City.

. . . Wichita and Tulsa could become process centers based upon piping petrochemical products to market areas and short-range shipments of intermediates to Kansas City for further processing.

. . . Products which, for physical or economic reasons, could not be piped long distances, might be moved 100 to 300 miles by pipeline to the Mississippi or Missouri rivers for barging to markets. **End.**

BOOKS

AUTOMATION AND OTHER TECHNOLOGICAL ADVANCES. (No. 205) 55 pp., paper back, $1.25.

Broadly, the basic problem of automation is to go from the "batch" concept of manufacturing to the "continuous flow" concept. Some industries — notably petroleum and chemicals—have solved the problem and have developed continuous flow production to a considerable degree. Subjects covered include: Problems in the Push-Button Factory, Mechanization of Small-Batch or Step-by-Step Production, The Role of Design in Automation, Effecting a Continuous Flow of Process Materials.

EFFECTIVE COMMUNICATION ON THE JOB. 294 pp. $5.50.

This work is joint effort by 22 writers. The discussions cover: Communication in the Management Job, Basics of Effective Communication, Roadblocks to Understanding, How to Plan Your Communications, Introducing the New Employe, How to Get an Idea Across, How to Instruct, Giving Orders, Reprimanding, Talking Safety to Your Workers, Rumor Must Be Reckoned With! What Your Boss Wants to Know, Stimulating Upward Communication, The Communication of Merit Ratings, Complaints and Grievances—Getting at Causes, Some Guides to Employment Interviewing, How to Lead a Conference, When You Have to Make a Speech, Five Steps to a Better Talk.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

Index (1946=100)

	1949	1952	1953	1954	1955	Sept. 1956
Pumps, compressors, etc.	135.9	155.6	162.5	166.5	172.2	196.6
Electrical machinery	130.9	152.4	156.4	160.0	162.5	177.8
Internal-combustion engines	124.8	146.5	148.1	150.5	153.2	163.6
Instruments	123.1	146.2	151.8	154.6	162.9	181.9
Heat exchangers	133.0	165.8	174.9	171.7	156.8	197.8
Miscellaneous equipment average	*121.6	153.3	158.8	160.7	161.5	183.5
Materials component	143.6	164.3	172.4	174.6	176.1	197.4
Labor component	137.1	163.1	174.2	183.3	189.6	201.0
Nelson construction index	139.7	163.6	173.5	179.8	184.2	199.6

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

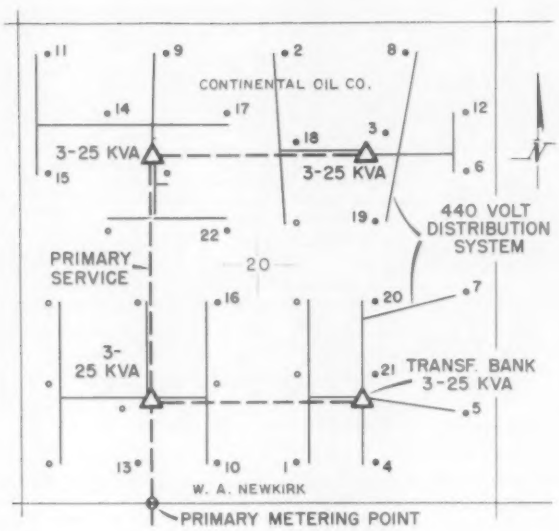


Fig. 1.

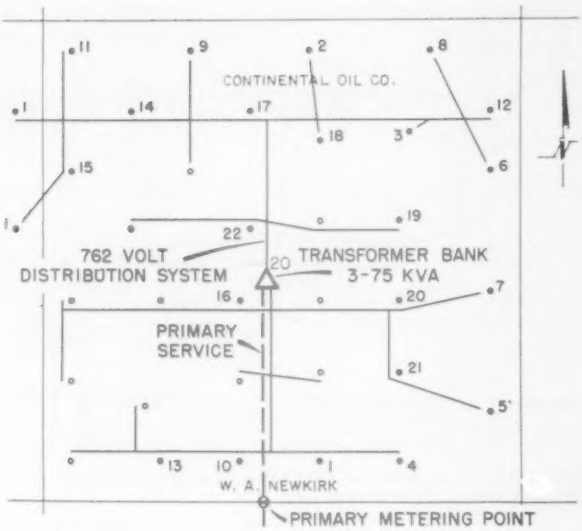


Fig. 2.

These layouts, for 440-volt system (left) and 762-volt system (right) show why

Continental Finds 762-Volt Power Cheaper

In two pools in western Kansas 762-volt electric power systems for pumping wells have been 12.5 and 14 per cent cheaper than 440-volt systems. Savings are in the reduction of transformers, transformer stations, and primary electric lines.

by C. A. Bingham

OVER 30 years ago, Continental Oil Co. started using electric motors for pumping oil wells. These oil wells are spread out over 12 states and today better than 60 per cent of them are electrified. However, this progress toward electrification has been slow. Rural electrification and increased generating capacities of the utility companies has been necessary. In a few cases, we installed our own generating plants. All of our pumps used 440-volt motors up until 1955.

In 1955, we installed and put in operation 762-volt systems. Two installed 762-volt systems are involved; one in the Morel pool and one in the Rhodes pool, both located in western Kansas.

The Morel pool consists of nine leases covering 1,440 acres, on which 33 wells are currently producing. An individual well survey in this pool indicated that 515 hp., which includes two salt-water disposal pumps, would be required for electric pumping.

The Rhodes pool consists of 10 leases and 3,040 acres and 51 producing wells have been drilled. This pool requires 260 hp. now and will ultimately require 500 hp.

Why 762 volts? . . . To illustrate a comparison between the usual 440-volt distribution system and a 762-volt system, we will use our Newkirk lease in the Rhodes pool. This lease consists of 640 acres and 33 producing wells. Fig. 1 is a layout for a 440-volt system. Fig. 2 is for a 762-volt system. As expected, the difference is in fewer number of transformer stations and less primary line construction for the 762-volt system.

The foregoing figures are for use with aluminum conductors. Wire sizes are No. 4, No. 2, and No. 0. Pole spacing averages 350 ft.

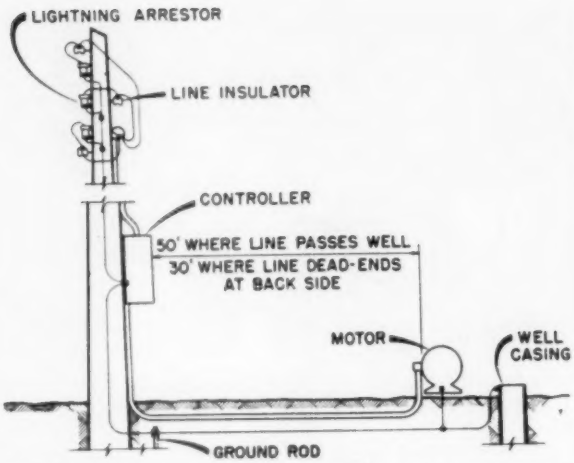
Slow speed . . . The Morel pool is an older pool originally equipped with single reduction pumping units and slow-speed gas engines. We selected a dual voltage 440/762-volt Y-gear motor as a low-cost means of providing slow-speed prime movers for lifting large quantities of fluid. Sufficient speed flexibility may be obtained by sheave changes and the gear motors have been entirely satisfactory. The additional 762-volt motor cost is considered in the cost summary and these dual-voltage motors were justified for replacement service on 440-volt systems.

Our longest secondary lines are approximately 1 mile, serving a 20 hp. motor with 60 hp. connected between the farthest well and transformer bank. Conductors are 1/0 for half the distance and No. 2 the remainder. Voltage regulation is very good.

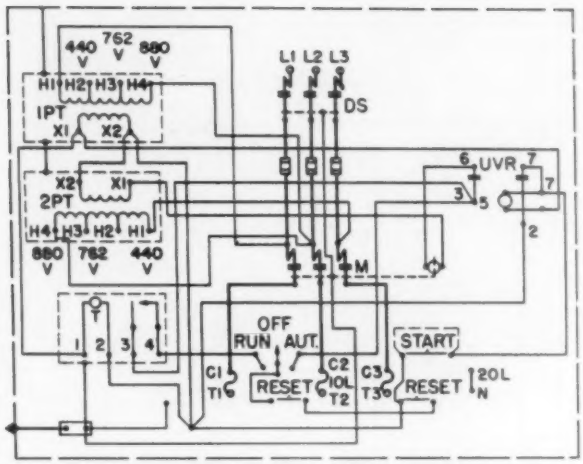
Encroaching water . . . Production in the Rhodes pool is obtained from the Mississippi chat. The reservoir recovery mechanism is primarily solution-gas drive. Most wells flowed from 1 to 2 years after completion. It is expected

Author is with Continental Oil Co., Ponca City, Okla. Paper presented at 1956 A.I.E.E. Electrical Conference of the Petroleum Industry, Kansas City, Mo.

PRODUCING



GROUNDING is to driven rods at controller pole mountings and lightning arrestors and to well casing. Fig. 3.



CONTROLLER WIRING provides protection against single phasing by control transformers across phases. Fig. 4.

the horsepower requirement during the life of the pool will be on a cycle of low, medium, and high, as reservoir pressure declines and water production increases.

It seemed a good application for triple-rated motors and 10-7.5-5-hp., 1,200-r.p.m. motors were selected.

Originally, the motors were connected 5 hp. It is believed the saving in demand charges and current consumption will be considerable over the life of the pool, and more than offset the slightly higher cost of triple-rated-horsepower motors.

Construction . . . From the motor, we go underground to the controller on the line pole with galvanized conduit and Type TW 600-volt wire. The voltage to ground is only 480 volts, thus we can safely use the 600-volt wire. The underground system provides maintenance safety and the controller provides disconnecting means away from the well. See Fig. 3.

Dual voltage controllers, conforming with N.E.M.A. standards for higher voltages, were selected. They have wider phase-to-phase clearance, heavier insulation, and heavier components than the 600-volt controllers. Three-coil overload heaters and the usual safety features were included.

". . . it is of utmost importance to provide complete and adequate grounding in 762-volt systems."

Positive protection against single phasing is provided by control transformers across phases. One transformer is placed on L-1 and L-2 for the time delay and clock, and another on L-2 and L-3 for the contactor. See wiring diagram, Fig. 4.

Lightning arresters are 500-volt pole mounted. The usual type of service connections were used with smaller conduit and conductor than would be used for 440 volts. See Fig. 3.

In constructing 762-volt, three-wire distribution systems, it is of the utmost importance to provide complete and adequate grounding. In both pool systems discussed, whenever possible all grounds were made by clamps to well casings. Driven rods also were installed at the controller pole mountings and arresters, the ground wire being connected to both well casing and ground rod. No electrolytic corrosion of the well casing is expected from this wiring system.

Costs

A cost comparison is shown in Table 1. As was expected, the largest savings are reflected in the number of transformer stations, transformers, and primary electric lines for the 762-volt system. This system also shows greater costs for motors, controllers, and secondary lines. The costs of motors and controllers for a 762-volt system is 5 per cent higher than like equipment for a 440-volt system. These cost savings will be reflected throughout the complete system.

The over-all savings in installed cost for the 762-volt system and equipment in the Morel pool was 12.5 per cent less than for a 440-volt system. The savings in the Rhodes pool was 14 per cent. The comparatively short time of operation of the systems has not permitted an evaluation of the savings in line losses.

There has been little maintenance to date, and it is not expected to be greater than on comparable 440-volt systems.

The use of dual voltage motors, controllers, and standard voltage transformers allows the use of 762-volt equipment on 440-volt systems, either for replacement service or for new installations.

No general statement may be made regarding higher voltage for oil-field distribution systems. However, where leases are checkerboarded, spacing is wide and loads are heavy; a comparison of the systems should be made for possible savings in the higher voltage systems.

TABLE 1—COST COMPARISON OF 440 AND 762-VOLT POWER SYSTEMS FOR PUMPING, NEWKIRK LEASE, RHODES POOL, 33 WELLS, 640 ACRES

Equipment and amount—	Cost— 440-volt system	762-volt system
Motors—33	$6,905.25	$7,231.95
Conduit and wire (A.S.S.R.)—33 sets	1,611.39	1,060.95
Controllers—33	8,910.25	10,197.00
Primary line—(9,240 ft. 440-volt and 2,640 ft. 762-volt)	2,772.40	792.00
Secondary line—(27,600 ft. 440-volt and 29,360 ft. 762-volt)	9,936.00	10,569.60
Transformers—(300 kva. 440-volt and 225 kva. 762-volt)	4,552.00	2,343.00
Transformer stations—(four 440-volt and one 762-volt)	4,148.00	1,037.00
Total cost	$38,835.29	$33,231.50
Cost savings		$5,603.79

Radioisotopes in Refining—4

Shell Puts Radioisotopes to Work

. . . to improve a variety of refining operations

These case histories outline several instances where engineers of Shell Oil Co. and Shell Development Co. have used radioactive isotopes to improve refining operations.

THESE abstracts from detailed reports outline materials, equipment, and procedures employed in detecting leakage and entrainment, and in studying the aging, mixing, and attrition of fluid catalyst in commercial refining units.

Since the results of these studies are of value only to those directly concerned, this report contains only generalizations on findings from the tests. The purpose of this series is to outline how radioisotopes can be used to improve refinery operations, rather than what specific results were obtained in each example.

Leak Detection

Without shutdown or excavation, radioactive tracers can prove or disprove leakage in almost any refining situation. Tracers can also localize and measure the extent of leakage.

Case 1 . . . In a crude-oil handling system segregated stocks to a Dubbs unit and to crude-distillation units, leakage through a closed valve from one stream to the other was suspected. Yield discrepancies indicated that sweet crude for the Dubbs unit might be leaking through one or more closed valves to mingle with sour crude to the distillation units. But leakage was not definitely proved and could not be detected without shutdown.

. . . Wanted. Definite proof or disproof of leakage, localization and quantitative measurement if proved.

. . . The test. A barium 140 salt of high-molecular-weight sulfonic acids was selected as the tracer. This liquid was transferred by suction to the lower chamber of a charge vessel attached to the inlet line of the dock pump moving sweet crude to the Dubbs unit.

The upper chamber contained wash oil to remove all tracer from the injection vessel. Both liquids were injected quickly into the line by nitrogen pressure held at 100 psig. above line pressure.

Two Geiger-Mueller detectors, a laboratory monitor and a scaler were used together with an ionization chamber which acted as a portable survey meter. They were located, as shown in the flow diagram, to scan downstream lines.

. . . Results. After the survey meter at (1) recorded the passage of the tracer, both Geiger-Mueller counters were closely observed. Neither one showed any count-rate rise above background. Therefore if any leakage occurred, it amounted to less than 0.01 per cent of total flow. A leakage of 1.0 per cent would have given a count rate 100 times the limit of the detectors.

Case 2 . . . Dark-colored materials appearing in flasher overhead could be caused by:

1. Leakage in a heat exchanger.
2. Entrainment in the flasher column.

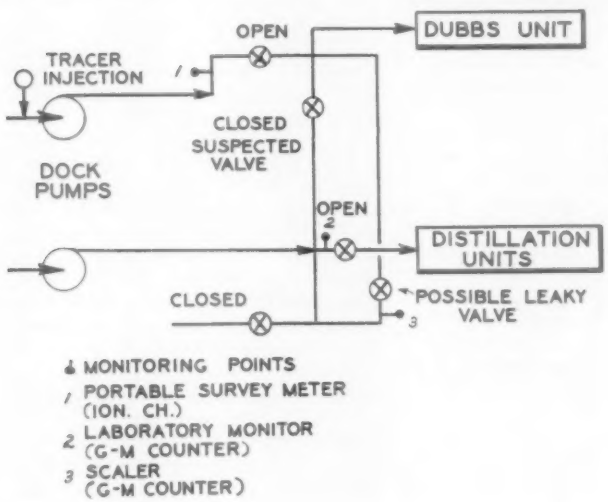
. . . Wanted. To determine whether leakage or entrainment or both were taking place. At the same time, a measure of residence time in the furnace was desired.

. . . The test. A 100 ml. sample of oil containing 3.2 millicuries of barium 140 was injected as in Case 1, at the indicated point in the diagram. The activity recorded by monitors at point 1 was noted immediately after each injection. No rise in count rate was noted within the interval required for tracer to enter the overhead line through a leak in the heat exchanger.

However, 12 minutes after tracer injection, the Geiger-Mueller laboratory monitor at position 1 recorded a rise

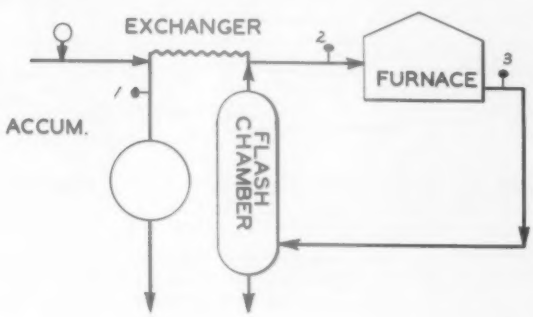
REFINING

Leakage Test



Earlier articles in this series appeared in the August 27, October 8, and October 15, 1956, issues. Two more articles will round out the series.

Leakage and Entrainment Tests



of 10-15 counts above background. This seemed to be well above the expected statistical variation of the background rate and would indicate that some of the heavy tracer was being entrained together with other nonvolatile materials, to the top of the flasher.

Observation of activity detected at points 2 and 3 gave a measure of the residence time and degree of mixture of the tracer and charge stock in the furnace.

Both Case 1 and Case 2 were carried out by personnel of the Houston refining research laboratory of Shell Oil Co. Information is from unpublished reports.

Fluid Catalyst Studies

In evaluating the design and operation of large fluid catalytic cracking units, it is necessary to know the rates and patterns of mixing of fluid catalyst in the different vessels of the unit. Radioactive tracers offer the only means for accurate studies of this nature.

Case 1 . . . A small amount (5-10 lb.) of catalyst tagged with cesium 144 or scandium 46 is injected in a matter of seconds at some selected point in a commercial-fluid catalytic cracking unit. Samples are then withdrawn rapidly at various points on the unit at intervals ranging from a fraction of a minute to tens of minutes following injection.

One-liter portions of these samples are then counted with a 2-in. NaI scintillation dip counter equipped with 2 in. of lead shielding. This method is highly sensitive. One millicurie of a 1 M.e.v. gamma emitting tracer when mixed with 500 tons of catalyst will produce 275 counts per minute per kilogram above a shielded background count rate of 200 counts per minute. A 10-minute counting time will give an accuracy of plus or minus 3 per cent.

Such mixing studies have been made on a number of Shell fluid catalytic cracking units. They can be carried out wherever sampling is possible. The count rate obtained at desired points gives a quantitative measure of the degree of mixing which takes place between points of injection and observation.

Case 2 . . . This type of study determines the rate of decline of surface area and pore volume of fresh fluid catalyst in a commercial unit. The nature of deactivation can also be studied. Rate of attrition and loss rate as fines are also measured.

Tagged fresh catalyst is used as in the mixing studies. Samples are withdrawn at intervals for weeks after tracer injection. These samples are then separated into a number of fractions of differing pore volume and surface area by the sink-float method. Because of the limited size of these various fractions (3 to 5 gr.) available for laboratory studies, from 20 to 30 times more radioactivity is required than is necessary for the simple mixing tests.

Each fraction is then counted with a scintillation well counter to determine the distribution of the aging catalyst in the various pore volume and surface area groups. These count rates are carefully corrected for tracer decay and other factors. Their comparison with the known distribution of the fresh catalyst provides the required information on aging.

The use of small samples and the long time period of this test requires the larger tagged injection. A typical dosage is 100 lb. of catalyst tagged with 35 millicuries of scandium 46. An injection of this magnitude is required for a commercial unit with a 650-ton catalyst inventory. Such studies are continued for as long as 35 days.

For stack-loss studies, a stack sampling device was developed. It accumulates 100 to 200 gr. of fines per hour. Small 15-minute samples are taken at desired intervals over a period of 2 or more months. They give an attrition pattern on the fresh catalyst as it ages.

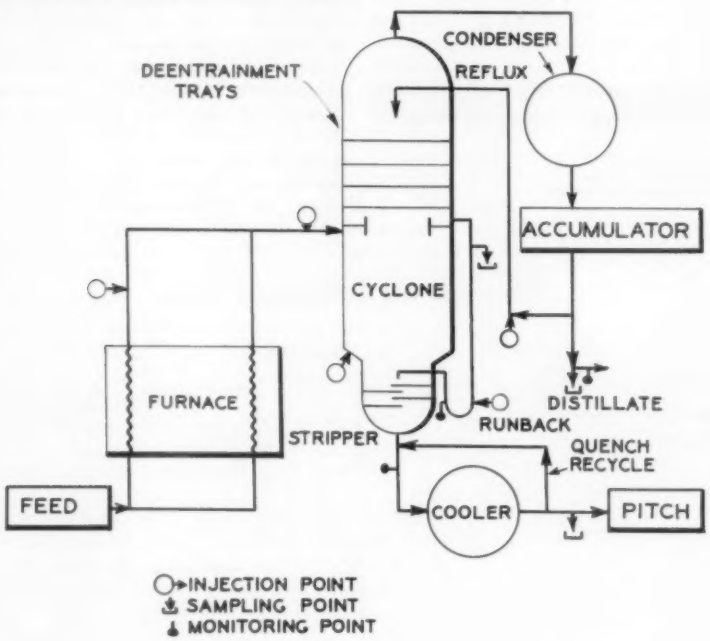
Case 3 . . . In one fluid catalytic cracking unit, simultaneous studies of three different catalysts were conducted. By this means aging and attrition characteristics of the three catalysts were determined under exactly identical conditions. This cannot be done in consecutive tests, since it is impossible to maintain all conditions and feed characteristics at a steady state over any period of time.

The three fluid catalysts to be tested were tagged with three different radioactive isotopes; secium 144, chromium 51 and scandium 46. As in the other tests, samples were taken at desired points and at intervals of 1.5, 6 and 39 hours, and 10 and 30 days. The samples were separated for examination by the same sink-float method, into smaller fractions of varying pore volume and surface area.

The 3-gr. samples were then counted in a 2-in. NaI well counter. The pulses from the three radiactive tracer sources were sorted according to size by a pulse height analyzer. This gave counting data which were coded for solution in a computer. The computed results showed the total count per minute per gram of each isotope for each sample corrected for decay and for factors involving the basis of random counts from the samples and background counts and counting times. Stack samples were collected and counted in the same manner.

For this triple-tagged study, the selected isotopes must satisfy several requirements. They must be strongly absorbable on fresh or equilibrium catalyst. They must remain absorbed at high temperature in both oxidizing and

Entrainment Study, Vacuum Unit



reducing atmospheres. They must be evenly distributed over the entire surface of the catalyst to give accurate results in attrition and aging studies.

The isotopes must be available in high specific activity so that the properties of the tagged catalyst are indistinguishable from those of untagged catalyst. The gamma ray energies of the three selected isotopes must be sufficiently far apart to allow resolution with the scintillation counter employed.

These fluid catalyst studies were carried out by Shell Development Co. They were reported by J. Kohl and R. E. Nather of Tracerlab, Inc., and V. P. Guinn of Shell before the Fourth International Instruments and Measurements Exhibition and Conference in Stockholm, Sweden, in September 1956.

Entrainment Studies

Vacuum distillation of crude bottoms is a well-known practice for obtaining added feed stock for catalytic cracking. But admission of heavy residual oil droplets to vacuum overhead streams by entrainment with lighter vaporized material can cause heavy coke laydown and contamination of catalyst by metals concentrated in heavy oil.

Such entrainment can be traced within a vacuum flasher, and measured quantitatively by the use of tagged nonvolatile compounds which follow the same routes as the heavy-pitch fraction. One such tracer which has proved successful is a barium 140 salt of Amberol, a high-molecular-weight phenol which is thermally stable and nonvolatile.

Isotope characteristics . . . An isotope to be used in this type of study should have the following characteristics:

1. A half life of between 7 and 30 days. A more-rapid rate of decay does not allow enough time to make adequate studies on commercial units. Longer half life permits lingering radioactivity in refinery equipment which would require special precaution if an emergency shutdown were in order shortly following a tracer test.

2. A high gamma-to-beta ratio of emission. Gamma radiation is more accurate and sensitive. Beta emission represents only an extra contamination problem.

3. An energy of more than 0.2 M.e.v. This permits efficient detection as the isotope decays, and eases the problem of calibrating monitors.

4. High specific activity to reduce the actual volume of tracer necessary for the test.

Barium 140 possesses these essential characteristics.

In entrainment tests on commercial units, the tracer can be injected rapidly in the pulse method, or it can be bled into the system over a period of time in what is called the steady-state method. Both have their advantages and both are often used in the same study program.

Pulse method . . . The pulse method is relatively simple. It reveals flow rates and recycling and mixing characteristics within the unit. The steady-state method permits performance of the unit to be averaged over a given period, and quickly detects any fluctuations in unit operation. It is also more accurate since it eliminates the necessity for integrading the long concentration tails of a pulse-injected tracer. It further relieves personnel from the need for accurate sample timing.

For thorough entrainment studies, mere proof that entrainment exists is not enough. Knowledge of where it occurs and to what extent is necessary to permit changes in unit design for improving distillate quality or increasing throughput, or both.

A representative study of this type was made on a vacuum flasher as outlined in the accompanying diagram. Feed is heated and partially vaporized in the furnace. Further vaporization takes place in the large transfer line to the flash tower.

A tray section in the tower is incorporated above the cyclone to remove entrained liquid not separated in the cyclone proper. The unit also includes a distillate reflux line, a pitch stripper, and a runback line returning entrained liquid from the trays to the stripper. Excessive cracking of bottoms is prevented by a quench recycle stream of cooled pitch.

Pilot runs . . . The entrainment test on this commercial unit required several days during which operation was maintained as constant as possible. Before the scheduled injection of the tracer, three pilot runs were made with small amounts of the isotope. These runs indicated the activity levels to be expected and the arrival times of tracer at the sampling and monitoring points.

Tracer was first injected into the top of the tray section (A) to determine optimum times to sample distillate and to find the extent of reentrainment of distillate in this section. Then followed successive injections at the furnace outlet (B), the transfer line (C), the cyclone closure (D) and the stripper (E).

During these pulse injections, activity was analyzed in the distillate, runback and pitch lines, both by examination of samples taken during the individual injection periods and by the monitoring of the three streams. Following these examinations, came a continuous steady-state injection during which the tracer was injected over a 75-minute period at transfer line (C).

This test had three purposes. It gave accurate calibration data for monitoring counters. It tested the steadiness of the flasher operation. It gave accurate data on the extent of entrainment in the unit.

Entrainment points . . . Data gathered from sampling and monitoring showed that entrainment occurred during each test, and revealed the major point of entrainment. In this case the greatest amount of distillate contamination occurred immediately downstream from the point where the runback liquid entered the stripper. It was concluded that turbulence in the stripping area plus flash vaporization of volatiles combined to produce small liquid droplets which were carried overhead by the stream current.

More detailed examination of data gave quantitative values for entrainment at the stripper, and for reentrainment at the distillate reflux. Further interpretation of corrected data provided a check on performance of the flasher unit as a whole.

"Admission of heavy residual-oil droplets to vacuum overhead streams by entrainment with lighter vaporized material can cause heavy coke lay-down and contamination of catalyst by metals concentrated in heavy oil. Such entrainment can be traced and measured. . . ."

Acknowledgment

These entrainment studies were carried out by Shell Development Co. and reported by C. D. Wagner, H. R. Lukens and R. R. Hughes in Nucleonics, April 1956, Vol. 14 No. 4, pages 78-83, 128.

THIS SLIM HOLE RIG can handle the drilling in the Illinois basin profitably because of its flexibility and mobility.

Slim Holes Get Job Done In Tristate Area

by Arnold F. Lewis
Lewis Drilling Co.

PRODUCERS and drilling contractors all over the tristate area of southern Indiana, southern Illinois, and northwestern Kentucky are becoming ever more conscious of the effectiveness, economy, and practicability of slim-hole drilling. It has been conclusively proved in this area that production from 5⅝ to 6¾-in. holes is just as effective as production from holes 7 in. or larger, and much more economical.

Pictured here is a slim-hole rig operating in this area. The completely portable rig is rated at 117 hp. at 1,800 r.p.m. It is equipped with a racking platform for pulling doubles.

The unit and mast are mounted on a tandem-axle, dual-wheel lowboy trailer. The top section of the mast telescopes down into the bottom section, and is hydraulically lowered to a horizontal position on the trailer for roading.

The rotary table is mounted on a substructure 4 ft. high; this gives ample room for flow nipple connection and blowout preventer. The mud pump is skid-mounted, the complete unit weighing slightly more than 7 tons. A 5-by-10 pump is used rather than a larger pump because of its lighter weight, and due to the fact that 2⅞-in. drill pipe is used.

Advantages . . . The economic advantages to both the producer and contractor in drilling slim holes may be easily seen. Besides a decided savings in drilling and completion costs, there is also a time savings involved in moving, rigup, and rigdown time. These all add to the efficiency of slim-hole drilling.

For the producer, cementing costs, casing costs, and all completion costs are greatly reduced. For example, in this area, the price of 4½-in. continuous weld casing is $104.48 per 100 ft., whereas the price of J55 5½-in. casing is $163.30 per 100 ft. Thus, in casing alone, there is a savings of over one-third. Because a smaller crew is needed to operate a slim-hole rig, there is also less day-work or rig-time cost for the producer.

Moves quickly . . . For the contractor, moving costs are less, due to the fact that there is much less weight to move than on a larger rig, fewer loads are required, and fewer man-hours are entailed. The rig is moved with the blocks strung up, a further time-saving device. Due to the relatively light net weight of 26,000 lb. on the trailer tandem axle, no special permit is required to move the rig. The rig and all necessary equipment is moved in three to four loads, depending upon the depth of the hole to be drilled. This rig can be rigged up and turning to the right within 2½ hours after reaching location.

Fuel consumption is less than on the larger rig. For instance, the fuel consumed in the rig shown has averaged about 1 gal. per foot drilled for mud pump, hoisting power, and rotary drive. A saving in drilling mud, drill string, drill collars, and bits may also be readily seen. The rig is handled very efficiently by a three-man crew, which further simplifies operations. The slim-hole rig, being lighter, smaller, and generally simpler than the conventional rig, entails less capital investment. In turn, there is less maintenance expense on the equipment.

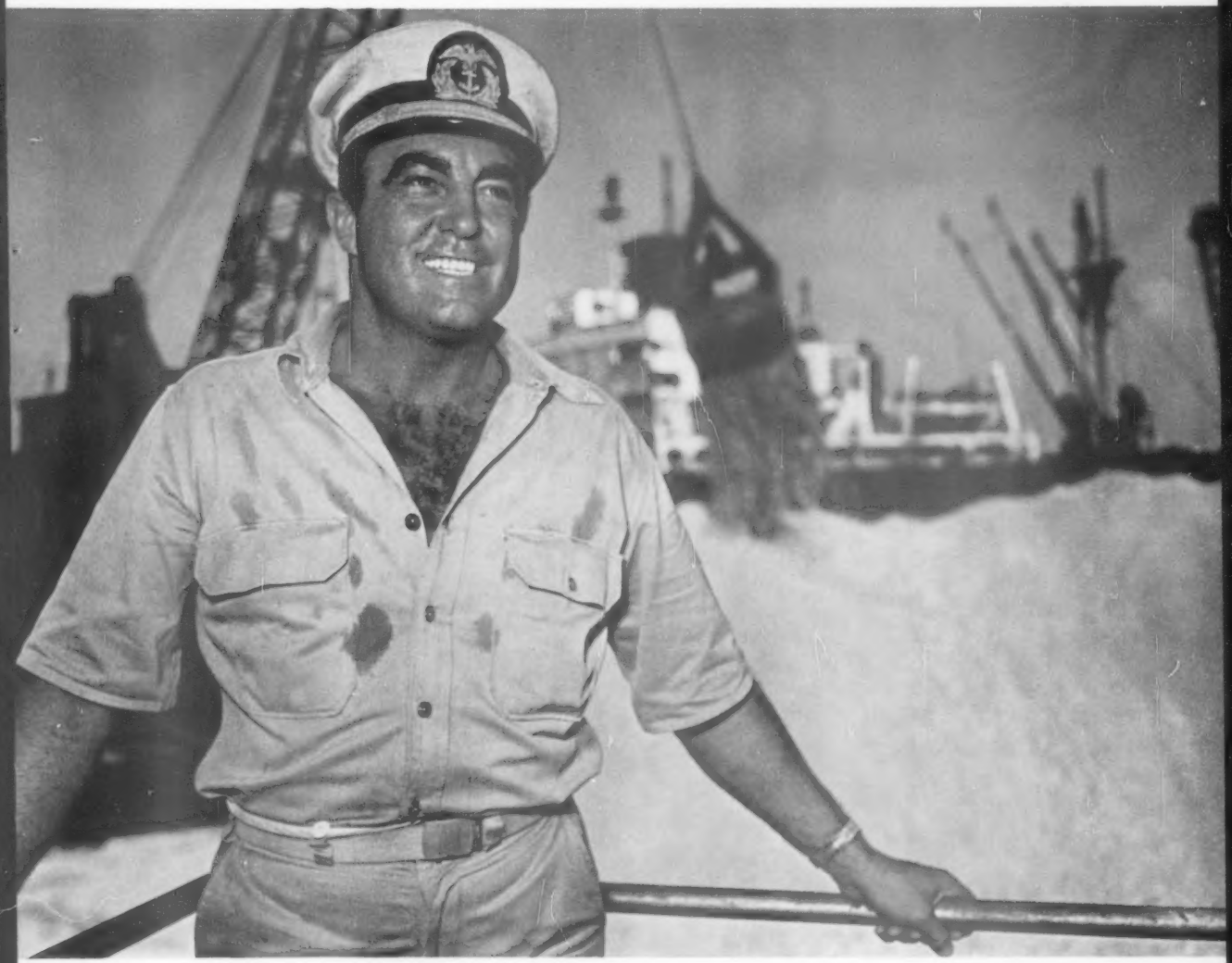
Typical depths . . . The typical drilling depths in the Illinois basin range from 1,500 to 3,500 ft. For such depths, the flexibility of this slim-hole rig is valuable. It is small enough that it can profitably drill a 1,500-ft. hole, but large enough to be capable of drilling 3,500 ft.

The three-man crew consists of the driller, the derrick hand, and the floor hand. The trips are made very easily and efficiently by these three men and the use of two automatic catheads—breakout and makeup—which are operated by the driller. The controls of the catheads, hoisting drum, and rotary table are grouped at the side of the derrick, just above the brake lever.

Going in the hole, after the floor hand sets the rotary slips, the driller steps out one step from his position at the controls, latches makeup tong, steps back to the controls, ready to engage makeup cathead, as the floor hand sets the backup tong.

Coming out of the hole, the floor hand sets the slim hole slips and latches both tongs while the driller operates the breakout cathead and rotary table.

It takes a complete team to keep dependable drilling mud available for you



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Here's what the engineer should be prepared to give testimony on

What is the formation which brings on need for spacing?

How big an area does the reservoir cover?

What kind of fluid does it produce?

What will be its depletion mechanism? Is it lenticular or are there other conditions of irregularity?

What is the productive thickness of the formation and what is its permeability?

Over what distance will a well drain?

What is the volume of the reservoir?

What will be recovery of oil and gas per unit area?

How much will development drilling cost?

What will be the completion costs?

How long will it take to recover the oil and gas?

What will be the cost of producing operations?

What is the present worth of future income?

Just what *is* the most economical size of a well unit?

The Practicing Attorney Gives Some Tips on

Courtroom Guidance for Young P. E.'s

by T. Murray Robinson

OIL and gas drilling or producing units and spacing orders are the result of an application and a hearing after proper notice given. This article will deal with the preparation necessary for the proper presentation of such an application. The controlling statutory provisions of the several states on this subject are accumulated in Sumner's Oil and Gas, and are easy to find*

To obtain an outline blank or form for such applications and notices, the secretaries of all oil and gas boards or commissions are invariably accommodating folk and will be happy to furnish you this material, or a copy of a previously given notice or of some other lawyer's successful effort. (Most agencies draw their own notices.)

Discussed here are the factual issues which may arise at the hearing, and the complexion of the evidence which may best be used to demonstrate such facts to the commission.

FIRST STEP:

A lawyer charged with the responsibility of securing a spacing order will first ask his client about the formation which is involved. In some instances this will be a well-defined, somewhat homogeneous body of rock and in other instances it will be a zone containing several porous intervals. The client (or his petroleum-engineer representative) will also be required to state with some certainty the area to which he wishes the spacing order to relate. He will be asked for his testimony to the effect that the subject area is or may be underlain by such common source of supply, and to advise if in the light of present information the proposed limits encompass the possible productive areas.

In some states spacing decisions may be made to areas without reference to the nature of the productive zone underneath such areas, and no requirement made that the order cover all the anticipated continuously productive area.

Further, in such states, it may not be a necessary condition precedent to prove the actual nature and existence of the reservoir sought to be spaced; but even in those states it is well to know the basic formation or zone which brings on the need for spacing so that the reasonableness of the request will be apparent to the board or commission.

SECOND STEP:

We now assume that the client, his engineers, and his advisers have reached a conclusion as to the spacing desired. In the courtroom, the next phase is how you can best sell your client's wishes to the board or commission, as to reasonable and proper spacing.

Not too long ago the effective drain-

*Sumner's Oil and Gas, Chapter 28, Volumes 5 and 5a.

". . . well spacing is primarily a means of encouraging reservoir development and properly distributing production among the owners."

age area of a well was given little consideration in determining well density. The density of the drilling was the result of the diversity or the lack of diversity of leasehold ownership, the initial potentials of the wells, the size of the operator's bankroll, and the capacity of the market to absorb the production from the field.

Knowledge Changes Practice

About 15 years ago (and that is late in the history of oil development), engineers became inquisitive about the relationship between the number of wells in a reservoir and the recovery of oil and gas. Now, petroleum-reservoir engineers agree that the recovery of oil and gas from a reservoir is almost independent of well spacing, and that the amount of oil and gas which will be recovered by primary methods will be about the same regardless of the number of wells drilled.

I am only a courtroom engineer; but I refer you to the various articles on reservoir engineering issued by the Engineering Committee of the Interstate Oil Compact Commission, and particularly to the article appearing in the Commission's Quarterly Bulletin of September 1951. That article will lead you into a wealth of technical material if you desire to pursue the subject further. The Engineering Committee of the Interstate Oil Compact Commission said:

"In summation the volume of recovery from an oil reservoir is normally less dependent on well density than on other factors . . ." and further,

"In conclusion, it is the opinion of this committee that, disregarding the element of time, there is not necessarily a relationship between well density and ultimate recovery from a reservoir. Rather, the ultimate recovery of oil is dependent upon the early application of good conservation practices."

I do not believe the problems relating to well spacing can be intelligently approached unless we accept this principle of reservoir performance. Accepting it, we must recognize that most of the factors which determine proper well spacing are only incidentally related to increased recoveries, and that well spacing is primarily a means of encouraging reservoir development and properly distributing the production among the owners.

Extreme lenticularity, and occasionally other conditions of irregularity, may tend to modify this statement to some extent, but it is an exceptional reservoir indeed that will produce enough additional oil and gas by close spacing to pay the cost of the infill wells.

Hydrocarbon reservoirs have more variations than the personality of women but, for the purpose of this discussion and the evaluation of the pertinent factors, they may be grouped into six general classifications:

1. Oil reservoirs with then sections of low permeability.
2. Oil reservoirs with thin sections of good permeability.
3. Thick but lenticular zones.
4. Oil reservoirs with thick, permeable sections.
5. Condensate reservoirs.
6. Gas reservoirs.

As we believe the selection of the proper unit size in each type of reservoir will come from the application of somewhat different yardsticks and principles, we will discuss each separately.

1. Oil Reservoirs With Thin Sections of Low Permeability

Under any time of spacing these reservoirs are marginal economically. Generally, fracturing or some similar process is required to cause the wells to produce at an economic rate, and the recovery is slow.

In such a reservoir each well must have a drainage area of sufficient size to contain enough recoverable oil in place to enable the operator to break even or make a small profit. Otherwise it will be difficult to attract even the so-called "tax-money developers."

If 40 or 80-acre spacing is proposed because each such portion of the reservoir will yield no more than enough oil and gas to pay for a well, the royalty owners, and perhaps some of the misguided operators, may set up a hubbub that in such a thin, tight reservoir a well will not drain the suggested tract.

Perhaps one well to each unit of the proposed size will not completely exhaust the unit of its recoverable oil and gas, but you will not recover enough additional oil by drilling two wells in the unit, or by reducing the size of the unit, to pay for the cost of the additional wells. It follows that the economic problem is the one with which the administrative agency should be the most concerned, and is the subject to which the applicant's evidence should be directed.

. . . You may ask, why have spacing at all? Why not let nature take its course? The answer is that if the area contains oil, proper conservation means the establishment of regulations to encourage the fullest possible development without hurt or harm to the industry to which the public must look for an adequate supply of oil.

Absent such spacing and only a few wells will be drilled and those on a close pattern. The decline of pressures in the development area will be rapid. Thus, the entire area will be blighted, preventing full development.

Please note that although I am suggesting that in this type of oil zone the minimum size of an economic unit should determine the well spacing and density, I do not mean to imply that such economic yardstick should be a determining factor, or perhaps any factor at all, in selecting spacing in other types of reservoirs.

2. Oil Reservoirs With Thin Sections of Good Permeability

Here it will be easy to establish that each well can effectively drain a substantial area. Additional wells will not increase the recoveries. They are needed only to help define the reservoir limits, to recover the reservoir substances at a reasonable rate and from the right location, and to provide each ownership tract with a share of the recoveries.

In accomplishing these objectives an agency must not set the size of a unit so small that if each unit is drilled the over-all development of the reservoir will result in an economic loss. The average reservoir unit should certainly return to the operator a profit.

Operators are human, and they will seek to recoup their investment in a well at as rapid a rate as possible. It follows that too much well investment is apt to bring about an insistence upon a too rapid depletion of the reservoir from the standpoint of good engineering practices, and perhaps oversupply the market in a particular area.

THE AUTHOR

T. Murray Robinson is senior partner in the firm of Robinson, Shipp, Robertson & Barnes, and is one of the most active and best-known lawyers specializing in well spacing, commission hearings, and petroleum litigation. He has been active in oil matters as a practicing attorney since his graduation from University of Oklahoma's law school.

This article is a portion of an address presented at the second annual Rocky Mountain Mineral Law Institute, 1956, in Boulder, Colo. It is part of a book of the proceedings published by Matthew Bender & Co., Albany, N. Y.

"... the unit should not be made so small that the average tract will not return a reasonable profit."

All these factors should be frankly disclosed to the commission by engineering testimony as to the nature of the reservoir, and by the statements of persons who, through experience, have an opinion as to the tempo of development which will result from the adoption of the proposed units.

3. Thick But Lenticular Zones

In this type of reservoir, engineers will probably agree that there is a possibility additional wells will provide additional recoveries since more of the separate sand lenses can be penetrated. If the lenses are connected, even though by areas of low permeability, all will eventually bleed into the well bores. Even though such wells are widely scattered, the reservoir will be drained with about the same effectiveness as normal, more homogeneous reservoirs.

Since closer spacing does safeguard against the contingency of overlooking a separate patch in the middle of the area, the proponents of closer spacing have a strong argument that the wells should be drilled as closely as the thick pay zone will economically support. But the unit should not be made so small that the average tract will not return a reasonable profit.

And it must be remembered that it is a very exceptional reservoir that requires closely drilled wells for complete drainage. Careful engineering appraisals should be made of the possibility of continuous sand lenses and of the economics of development. The former fixes the maximum limit, and the latter fixes the minimum limit.

From the operator's standpoint, **spacing is more imperative in this kind of reservoir than in any other.** Absent spacing and the problems which will confront the operator of protecting against offsets may get burdensome. If lenses exist that cut in and out of the sand body, unless the entire sand section is spaced as a single reservoir the operator may have unresolvable offset protection problems.

For example, assume A and B produce in a tract to the north, lenses B and C in a tract to the south, and A, B, and C produce in the center tract. All concerned will be much better served to have such lenses spaced as one common accumulation, or reservoir, rather than undertake to drill or separately produce each reservoir.

Without spacing, the operator of the tract in the middle would be required to drill more than one well, or triply complete. Such a method of producing is not desirable and will not recover more oil. Neither is it needed to protect correlative rights of the operators or lessors. If an adjustment is needed for such purposes it can be accomplished through the allowables of production to each well or tract.

It follows that in addition to presenting the usual type of evidence, that is, effective drainage area and economics, the operator should also present evidence as to the possibility of partially effective interconnection of zones through areas of low permeability, and should show the complications which might ensue in well development and control over production if all such lenses are not included in one order.

4. Oil Reservoirs With Thick Permeable Sections

In such a common source of supply the question of the ability of the operator to recover all of the costs of the wells which he may drill is not an issue. Economically, such a reservoir will support densely spaced wells. But the operator and the board or commission should use discretion, the first in seeking and the second in adopting proper spacing. If one well will effectively drain an area, why drill four, even though the total recoveries would be sufficient to return a fair profit on the dilling of four wells?

If such a thick reservoir is involved, the proponents of close spacing will not generally pitch their case on the incapacity of a well to drain a wide area, but rather will seek to prove that since profits can be made by close drilling the companies should be willing to develop on that kind of a program. Then the oil will be recovered for the lessors rather than their grandchildren.

Further, they will generally say that even if it is true that one well to a large area will eventually recover all the oil, that such should be disregarded and closer spacing required, since the lessors have no interest in the company augmenting its reserves of oil. Those proponents will further say that additional wells will not cause waste, and if perchance the recoveries of the reservoir are affected they will be increased.

Unnecessary wells in themselves are waste. The courts have so said,* and certainly a commission charged with the prevention of waste of oil and gas should not switch from a less expensive type of operation to a more expensive type of operation when the latter will not recover more oil. Such would cause waste of labor, materials, and dollars.

...In extremely productive reservoirs there is, of course, an economic factor which may make an operator desire to drill additional wells in order to obtain all of the oil and gas within the number of years past which an investment should not be protracted. Thus, it may be better to spend $200,000 drilling two wells and get a daily allowable for each, and thus exhaust the reservoir in 15 years, than to spend $100,000 drilling one well and take 30 years to exhaust the reservoir.

The present worth of the future income in the first instance may exceed the present worth of the future income

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*In **Coastal Club. v. Shell Oil Co.**, 51 F. Sup. 819, the court said:

"The eight wells that have already been drilled and that are now producing in the field are producing all the recoverable oil from the reservoir. This was supported by the evidence of the experts on both sides, and is pleaded by both parties. From the established premise that the wells in existence are capable of producing all of the oil in the field there follows indubitably the conclusion that the field as a whole has been adequately developed. Any additional wells would be unnecessary wells. In the recent case of Hunter Co. v. McHugh, Commissioner of Conservation, 202 La. 97, 11 So. Ed. 594, 510, the court said:

"Any well which will not increase materially the total ultimate recovery from the gas pool is an unnecessary well. The drilling and completion of every unnecessary well invariably threatens to cause physical waste of gas and results in an inefficient and uneconomic drainage area for such well."

The case was reversed on other grounds, 141 F. 2d 382, but the cited case, Hunter Co. vs. McHugh, was affirmed, 232 U.S. 222, 64 S. Ct. 19.

In **Southern Oklahoma Royalty Owners Association v. Stanolind Oil & Gas Co.**, 266 P. 2d 633, the court said:

"There is substantial evidence in the record that to require the drilling of additional wells to the various sands, instead of utilizing the wells already drilled, would place such a financial burden upon the operator, because of the small recovery of oil which could be anticipated, that the operator would sustain a loss and would therefore not drill the wells, thus preventing the largest ultimate recovery of oil.

"If, as contended by plaintiffs in error, the term 'economic waste' used in the statute does contemplate the waste of valuable material, skill, labor and gas fuel in the drilling of unnecessary wells, which to our mind it does, certainly the oil left in place and unrecoverable because it would be too costly to drill a separate well to recover it is 'economic waste' representing a loss to the landowner and royalty interest holders as well as to the state at large."

See also **Application of The British-American Oil Producing Co.**, 213 P. 2d 84.

". . . the advantages are many of starting with the laws of mathematics and physics in predicting the drainage through one well bore."

in the second instance by more than the additional development cost.

If for the foregoing reason your client desires close spacing, the present value of the dollars recoverable from close, as opposed to wide, spacing should be brought to the attention of the commissioners. If your client desires wider spacing, the unnecessary expenditure of dollars and the preventable waste of pipe should be your theme.

5. Condensate Reservoirs

In reservoirs of this type normally the ultimate recoveries are increased if the pressures are maintained above the critical point at which gases become liquids in the reservoir. As any withdrawal from the reservoir tends to reduce the pressure, when production commences pressures can be maintained only by the reinjection of equivalent volumes of dry gas.

The ideal production method is to withdraw wet gas, extract the liquids, and return the residue to the reservoir as dry gas. By continuing this cycling, substantially all of the liquids in the reservoir may be recovered, and the dry gas which remains may then be sold for domestic and heat uses.

Each well will drain a wide area, and it may well be that an irregular pattern will fit the mechanical operation of such a reservoir better than a uniform drilling pattern. As such a reservoir cannot be properly and efficiently operated without unitization, the wells should be widely spaced to start with. When the reservoir is defined and unitization accomplished, additional wells may then be located at the correct structural position for reinjection or extraction.

6. Gas Reservoirs

As to most gas reservoirs, engineers will say that one well will drain the entire reservoir if given sufficient time. It follows that spacing is needed only for the purpose of protecting correlative rights, providing wells to define the reservoir, and supplying the market. The larger the unit, the sooner in the life of the field will all owners of minerals start to participate in the withdrawals. The larger the unit, the fewer wells it will take to exploit the reservoir and find the edges.

In this case, where spacing is widest of all, a complaint is sometimes made that an operator is being spaced out of the reservoir if he drills a dry hole on the prescribed location. That statement constitutes an admission that he does not have a fully productive unit. In granting such an operator an exception to the pattern location, most agencies will adjust the allowable of production to the permitted well in such manner as to protect the correlative rights of the owners of the offset tracts that are underlain fully with productive rock.

THE HEARING

Synchronizing the Lawyers and Engineers

At this point, perhaps I have talked too much about the factors involved in a determination of proper well spacing. But it is important to make these factors apparent to a regulatory agency.

In the rehearsal which will precede the hearing the lawyer will insist upon straightforwardness from the witnesses. The witnesses will be professional men who will have such an established familiarity with technical and trade terms that they will use them without explanation, unless they are aware of the necessity for definitions and explanations. "Porosity" and "permeability" are but examples.

Further, such witnesses will be inclined to state conclusions without accompanying explanations. The lawyer will attempt to get them to fully explain the basic assumptions which they made, and the processes of reasoning by which they arrived at a conclusion as to the proper size of drilling and spacing units for the development of the area in question.

Explaining basics . . . Some regulatory bodies probably get a little tired of the educational approach in explaining anticipated reservoir performances. Certainly those commissioners who are professionally trained do. But the advantages are many of starting with the laws of mathematics and physics in arriving at a prediction of the drainage through one well bore.

In the first place, you generally have interested land owners in attendance, and at least some of them will appreciate a factual, scientific explanation of the reasons why the ultimate recoveries will be just as great with wide spacing, and the advantages thus gained in the proper control over reservoir production and in economic savings. In the next place, you may be looking around the corner to some court that could not qualify as a petroleum engineer. And in the third place, it takes a lot of education to get away from the historic concept—more wells, more oil.

It may be said that when a board or commission creates drilling and spacing units it, in fact, is exercising properly delegated, quasilegislative authority.* A parallel is the authority granted highway commissioners to set different speed limits on different portions of the state's highways, depending upon the different needs.

It follows that the same broad rules as to the admissibility of evidence which would apply to a legislative committee hearing should be adopted by the board or commission at its hearings. It is not unreasonable for a legislature, in deliberating the advisability of passing a law, to consider whether or not it will be popular law, although it should, where community good directs, be willing to pass an unpopular law. So in spacing hearings, it is common to permit everyone, expert or no, to have his say, with some reasonable restrictions as to relevancy to the subject matter.

The Engineering Testimony

There are a lot of ways of proving the amount of oil and gas which may ultimately be produced from a reservoir after that reservoir has a substantial production history. For example, pressure decline and recovery curves can be extrapolated. But spacing applications usually come before a commission before a reservoir has any substantial production history.

This means that recoveries will have to be estimated by the engineers, using calculations of reservoir pore space, with deductions for connate water, and applying a percentage factor, drawn from experience, to the oil and gas in place. The more the available information about the formation, the better job the engineer can do.

Get all data . . . If a core analysis is available, by all means use it. Electric logs, well-production tests, pressures, gas-oil ratios, water-oil ratios, singly or in combinations, may have to be relied on. After the engineer has made his computations, he should reduce them to a writing to be used as an exhibit in the hearing. Copies of the basic data should also be brought to the hearing. Most commissions will accept laboratory analyses without the presence of the person who actually made the analyses.

After total recoveries from an aver-

*See, for example, the judicial treatment of the problem in **Croxton vs. State** (Okla.), 97 P. 2d 11.

". . . additional wells, if needed, can be drilled any time, but no way has yet been devised for undrilling unnecessary wells."

age proposed unit are estimated, economic computations can be made, taking into consideration the time needed to recover the oil and gas and the expected production costs. If such economics are to be an integral part of the proof, they should, for exhibit purposes, likewise be reduced to writing, with an explanation of each step involved in the determination.

If the basic issue is simply the lateral distance which a well will drain, in addition to a detailed explanation of the movement of fluids in the reservoir, the engineer may wish to produce charts and graphs illustrative of interwell pressure distribution. Perhaps he well even present technical papers and books on the subject to support his own opinion. Sometimes such papers are admitted and sometimes not. Their effect is the same in both cases.

The Geological Testimony

The geologist does not reach back so basically to mathematics and physics. His function is to interpret and analyze the structural or depositional features of the producing rock. His opinion is normally based on many variables and assumptions which may be disproved later.

But he is entitled to an educated guess and that opinion is probative proof. Its weight increases with the reasonableness of the explanation as to how he arrived at that opinion. If it is based on subsurface analysis, regional trends, seismograph, or whatever, he should explain to the commission how he arrived at his opinion, stating the basic assumptions which were made, and in general the thinking processes employed in route.

Most companies feel that seismic information is personal and too valuable to be publicly released in the early stages of a reservoir development. It is often difficult to persuade the management to let the geologist take such with him to the court room. If the seismic data, or other such electrical or mechanical data, are a part of the witness' opinion, the lawyer should insist on the right to take such seismic maps or interpretations to the court room.

Conclusion

Always remember that additional wells, if needed, can be drilled at any time, but no way has yet been devised for undrilling unnecessary wells. The oil man with his hand on his pocketbook necessarily looks with great longing at the location on his lease which is closest to production.

His apprehension of getting too far away and drilling a dry hole is understandable, but if the reservoir does not extend far enough back from his lease line to provide a normal location, the chances are that there will not be enough reservoir around the crowding location to make drilling profitable. Maybe he had better not drill at all unless the normal location will produce.

The natural desire to get in close to production at times puts a great strain on the commission to deny proper spacing. If the people who put that strain on the issuance of such orders could but step back and take a longer and wider look, they might have less reluctance to accept the chance involved in being pushed back from established production to embrace the increased chance of over-all commercial operations.

Remember the lessor . . . Another thing is the tendency on the part of some commissions to overemphasize the correlative rights between tracts, and to overlook the correlative rights which exist between lessors and lessees. There always is a conflict between the position of royalty owners and the operating lessee. It exists with or without spacing.

As the royalty owner has the free ride, it is to be expected that his position will be that every well which will increase the rate of recovery should be drilled. To require the lessee to drill all such wells might violate a well-established legal principle concerning the correlative rights of the lessors and lessees.

If additional wells will not bring in additional recoveries in an amount sufficient to pay their costs, the spacing should eliminate such additional wells. Otherwise the lessees are required to drill uneconomic wells. I have participated in many hearings in which the preponderance of engineering opinion was that the additional wells which would be authorized under the advocated closer spacing, as opposed to the advocated wider spacing, would produce some additional recoveries but not enough to pay the cost of such wells.

Wells should pay . . . It has long been a judicially accepted norm that in determining the development required as between lessees and lessors, the lessee is not required to drill any well which, to him, would be uneconomic. Patently, if the extra well will cost $80,000 and will recover $40,000 of substances which the first well will not recover, the lessee would lose at least $45,000 by drilling such well, because out of the $40,000 recovered he will have to pay a one-eighth or more royalty. The royalty owner would, of course, gain $5,000.

We ask: Is it a fair adjustment of the correlative rights of these two types of owners of mineral rights to require that the lessee lose $45,000 in order that the mineral owner may gain $5,000? The courts have uniformly said no.*

Postscript

In the discussion period following the delivery of the paper, the questions propounded indicate that some listeners believed that a spacing pattern of 40 acres or more had been recommended for oil development. I hope those who read will not so believe. The selection of proper spacing is an engineering problem, not a legal problem.

Not long ago history and precedent dictated 10-acre spacing for oil wells. The engineers have broken from this and now recommend 20, 40, 80, 160-acre and even greater drainage units depending upon the condition and structure of the reservoir involved. The point made, if any is, is that such scientific appraisals and testimony should be listened to; precedent and history, for the most part, should be disregarded. When we want meat we no longer hunt with bows and arrows.

This is not to say that the engineers will, or might, properly recommend only one well for each field. Certainly enough wells will have to be drilled to provide the producing flexibility needed for the good conservation practice of drawing more heavily on the low gas-oil ratio wells. And certainly enough wells will have to be drilled so that the maximum efficient field recovery can be obtained without exceeding the maximum efficient rate of recovery from the wells.

*In **Brewster v. Lanyon Zinc Co.**, 140 Fed. 801, a case which may be characterized as an origin case, the court said:

"The large expense incident to the work of exploration and development, and the fact that the lessee must bear the loss if the operations are not successful, require that he proceed with due regard to his own interests, as well as those of the lessor. No obligation rests on him to carry the operations beyond the point where they will be profitable to him, even if some benefit to the lessor will result from them. It is only to the end that oil and gas shall be extracted with benefit or profit to both that reasonable diligence is required."

See the authorities collected in Paragraph 414 of Sumner's Oil and Gas.

ELEMENTS OF FIELD PROCESSING—25

Relief and Venting Equipment

by Dr. John M. Campbell
University of Oklahoma

THE installation of proper relief and venting equipment is an integral part of the control system. No vessel should ever be installed, regardless of the pressure range, without provision for the adequate relief of excess pressure.

The specifications governing such relief equipment are normally set up under one or more of the following codes:

1. A.S.M.E. Unfired Pressure-Vessel Code.
2. A.S.M.E. Power Boiler Code.
3. A.P.I.-A.S.M.E. Unfired Pressure-Vessel Code.

With the possible exception of L.P.G. systems and steam generators most lease equipment is built and installed under the last code. This code provides that all unfired vessels shall be protected by a pressure-relieving device that will prevent the pressure from rising more than 10 per cent above the maximum allowable working pressure stamped on the vessel.

The pressure-relieving device may be a relief valve and/or a rupture disk. The former is ordinarily a direct-acting spring-loaded valve except that a pilot-loaded valve may be used if it is of the normally open type and will discharge its full rated capacity when the pilot fails. This spring-loaded valve, though, offers economic advantage and is dependable.

... The rupture disk is carefully made in such thickness and shape that it will burst at a given pressure ±5 per cent. These disks have the advantage of being very positive, providing a tight seal and being available in many special metals at moderate cost. In most sizes the disk is supported between a special flange but small union type and threaded "throwaway" models are available. The primary disadvantage is that it cannot seal off again after relief of pressure.

Both a relief valve and rupture disk may be used in parallel, in which case the valve is usually set for 10 per cent overpressure and the rupture disk 50 per cent. A rupture disk may also be connected in series with the valve, either before or after, provided certain special code stipulations are met.

A rupture disk may be placed ahead of the relief valve to prevent leakage or to isolate the valve from viscous or corrosive materials. In this case the disk should have a slightly higher bursting pressure than the valve set pressure. It is necessary to have a connection between the two to check the intactness of the disk and enough room so that the disk may rupture completely. In fact some provision to prevent it from fouling the valve is often indicated.

On certain systems the rupture disk may be placed on the valve outlet, the sole function being to prevent leakage of valuable or noxious materials. If this is done a back pressure is superimposed and a bellows type of valve or equivalent, discussed below, should be used.

Rupture limit . . . Regardless of the use, the rupture disk should have a bursting pressure at least 50 per cent above the maximum normal operating pressure for the best service. This can be a serious limitation where the code specifies that the vessel pressure shall not exceed the vessel working pressure by over 10 per cent. Unless some other arrangement is negotiated with the insuring company this means that the vessel's working pressure has to be 1.36 times the anticipated operating pressure if the above two conditions are strictly adhered to. This certainly limits the application.

In choosing the material of construction it is also necessary to consider the temperature at which the disk will operate and the materials with which it will come in contact. At elevated temperatures metals lose their strength while at low ones embrittlement is a problem. Fortunately many alloys are available to minimize the problem.

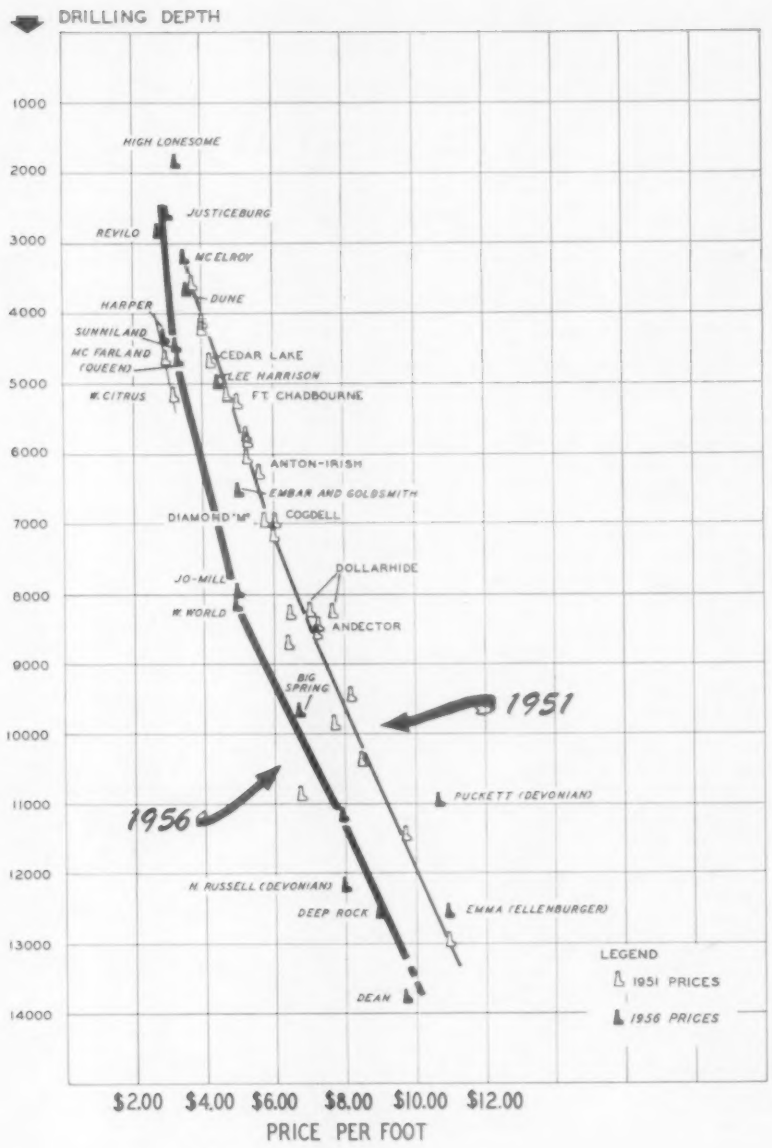
Precautions . . . When installing a relief system the following general provisions should be considered:

1. Vessels completely filled with liquid should have a liquid relief valve with a diameter not less than that of ½-in. pipe.
2. No obstruction should be present between the vessel and the relieving device and the pipe should be at least as large as the valve inlet.
3. When two or more pressure-relief devices are connected to the same opening, said connection should have a cross-sectional area equal to the sum of the areas of the device inlets.
4. The spring in a relief valve should not be reset for any pressure that deviates more than 10 per cent from the specified valve pressure when the total pressure does not exceed 250 psig. Above 250 psig. only a 5 per cent deviation is allowable.
5. When two or more vessels are connected together by adequate piping, without valves, so that the vessels may not be isolated, these vessels may be considered as one unit in calculating relief requirements.
6. Where an additional hazard such as fire is present, as in hydrocarbon storage, supplementary relief devices are necessary. They must be sized so that the pressure shall not rise over 20 per cent above the vessel's maximum allowable working pressure.
7. All relief valves should open at the maximum allowable working pressure of the vessel.
8. A plug valve may be placed between the relief valve and the vessel provided: (a) that said valve will not reduce the relieving capacity, (b) that the valve is sealed open and is closed by an authorized person only where repairs or other work demand it.
9. Any vent system downstream from the relieving system should be designed to minimize the effect of variable back pressure, contain no plug valves except as provided in (8) and be designed to facilitate drainage.
10. The pressure drop in discharge lines should ideally not exceed 10 per cent of the set pressure. One common practice is to size this line so that its area is equal to that of all the valve outlets discharging into it.

Back pressure . . . Two types of back pressure are encountered in vent systems, viz., "built up" and "superimposed." The former is the type of pressure that builds up after the valve opens, particularly where the lines are long. A superimposed back pressure is one that exists by virtue of deliberately holding a pressure on the system or from the prior opening of other valves. In either case the back pressure must be dissipated from (or prevented from entering) the bonnet since this force would act as an additive force to the spring and prevent the valve from opening at set pressure.

One manufacturer minimizes this difficulty by using an eductor tube which keeps the bonnet pressure low when only "builtup" pressure is encountered. However, where the superimposed back pressure is high or variable it is necessary to keep this pressure from the bonnet and the working parts. The best way of accomplishing this is probably to have a bellows that seals off the bonnet and working parts from the outlet fluid. This bellows also serves to protect against corrosion, viscous fluids, and contamination.

FIELD PROCESSING



A look at West Texas footage prices on chart shows that

Drilling Contractors Offer Best Buy in the Oil Business

by Norman S. Morrisey
Drilling-Development Editor

THE best bargain in the oil business today is a foot of hole drilled by a contractor. Contract footage prices have been steadily dropping during the last 10 years. Cost of labor and materials has been steadily rising. Today oil companies get 25 per cent more hole drilled for the same money than they did 5 years ago.

The Journal has just completed a survey of the footage prices paid drilling contractors in the most active oil fields of the United States and Canada. The table shown lists the current footage prices and day-work rates.

But compare the 1956 figures with those of 1951! Today in West Texas, for example, contractors can drill an 8,000-ft. field well for as little as $40,000. Five years ago an oil company paid a contractor $53,500 to reach the same depth. Similarly, a contractor received $82,500 for a 10,000-ft. well in 1951. Today he digs the same well for $67,500.

Footage prices are down about 25 per cent since 1951, although labor prices have risen 28 per cent. Increases in the price of steel and labor have upped equipment prices 23 per cent in only 5 years. **Yet the drilling contractor has managed to reduce footage prices substantially in the same period.** Today oil companies are buying a real bargain from the drilling contractor!

Several factors explain why footage prices have dropped, but the real answer lies in the individual **contractor's ability to meet competition and steadily improve his performance.** He has used every method at his disposal to keep his rigs turning to the right and still show a profit.

Among the more important improvements during the past 5 years have been . . .

- Better bits.
- Improved hydraulic systems.
- Better mud programs.
- Rig efficiency.
- Mobility of drilling rigs.
- Slim-hole rigs.
- Air or gas drilling.

In many areas, several of these factors have combined to enable the contractor to meet competition and give the oil company more for its money.

West Texas . . . The Journal's survey was most complete in West Texas, both in 1951 and in 1956. The two curves are compared (see graph), and the decrease in footage price in the 5 years is obvious. Probably the problem is or has been more acute in West Texas, because of the large number of rigs that were available when the Spraberry activity declined so rapidly. However, the same trend is apparent throughout the United States.

Footage prices have remained fairly constant in the shallow fields in West Texas during the past 5 years. This is due to the fact that there is little opportunity to improve performance in these shallow holes.

In the deeper fields, however, drill-

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Representative Field Prices in the United States and Canada 1956

ROCKY MOUNTAIN

Area and field—	Footage price	Contract depth (ft.)	Day-work rate	Days on footage	Days on day work
WILLISTON BASIN:					
Antelope		9,150	$925		46
East Poplar	$5.25	5,900	$850	20	5
CENTRAL MONTANA:					
Wolf Springs	$5.50	6,235	$750	14-16	6-10
WYOMING:					
Beaver Creek		11,500	$950		90
Cottonwood	$5.45	6,000	$800		
Donkey Creek		6,300		12	2
Winkleman Dome	$5.45	3,600	$675		
Winkleman (Curtis sand)	$8.00	2,750	$700	30	8
DENVER-JULESBURG BASIN:					
Cizek	$2.65	5,700	$650	9	2
Lovercheck	$2.60	6,300	$650	10	4
Xenia area	$2.75	3,900	$600	5	2
WESTERN COLORADO:					
Thornburg	$9.50	4,400	$745	30	6
PARADOX BASIN:					
Aneth	$8.50	5,900	$825	41	18
SAN JUAN BASIN:					
Bisti-Black Rock	$3.50-$4.50	5,085	$650-$700	11-14	1
Blanco	$4.50	5,800	$725	13	3
Fulcher-Kutz	$3.00-$3.50	1,900-2,500	$500-$650	4-6	4-6
Tapacito	$3.00-$3.50	4,000	$650	7	3
Ignacio	$4.40	5,600	$650	15	10

WEST TEXAS-NEW MEXICO (DEEP)

Andrews (Wolfcamp)		8,700-9,200	$900	55	17
Big Spring pool	$6.75	9,700	$850-$900	48	15
Dean (Devonian)	$9.00-$9.75	13,800	$1,000-$1,200	121	16
Deep Rock (Ellenburger)	$9.00	12,260	$1,000	89	10
Dora Roberts (Ellenburger)	$9.00	13,200	$1,000	40-50	30-40
Emma (Ellenburger)	$10.50	12,600	$1,000	90	28
Fluvanna	$6.75	8,500	$725		
Goldsmith (Ellenburger)	$7.00	9,000	$900	68	17
Hutex (Devonian)		12,575		60.5	7.5
Lane Ranch	$8.00	11,000	$1,000	80	10
North Monahans (Devonian and Ellenburger)	$10.00	13,000	$1,020		
Puckett-Devonian	$10.75	11,000	$825-$1,025	80	5
Russell, North (Devonian)	$8.00	12,200	$925	55	5
South Cowden (Ellenburger)	$9.00	13,300	$1,000	97	20
World, West (Strawn)	$5.00	8,200	$750-$850	31	7

WEST TEXAS-NEW MEXICO (SHALLOW)

Dune (San Andres)	$3.50	3,700	$650	13	1
Embar (5,600 ft.)	$5.00	6,500	$675	34	5
Goldsmith (5,600 ft.)	$5.00	6,500	$675	34	5
High Lonesome	$3.25	1,875	$240	23	8
Harper (San Andres)	$3.00	4,400	$600	8	3
Justiceburg (Glorieta)	$3.00	2,600	$650	7	
Jo-Mill	$5.00	8,000	$750-$850	27	5
McFarland (Queen)	$2.75	5,000	$575		
Sharon Ridge (1,700 ft.)	$3.00	1,700		24	3
Welch	$3.30	5,000	$650	12	3
Lee Harrison	$4.50	5,000	$700	17	5
McElroy	$3.50	3,250-3,400	$648	18	15
McFarland (Queen)	$3.25	4,700	$600	12	3
Pecos Valley	$4.00	1,630	$216	20	10
Revilo (Glorieta)	$2.75	2,800	$475	7	1
Sunniland	$3.25	4,500	$450	17	4

TEXAS PANHANDLE

Farnsworth (upper Morrow)	$5.50	7,900	$750	27	6
Hugoton	$3.00	3,100	$550	8	
Panhandle, West	$3.00	3,400	$520-$550	8-10	0.5
Quinduno	$5.00	6,500	$750	33	5

NORTH TEXAS

Archer County Regular	$3.00	4,800	$550	11	1
Fargo, East	$3.75	6,000	$800	15	2
Joy	$3.50-$4.50	3,900	$650-$750	9	2
KMA	$3.00	4,025	$550	7	0.25
Langston-Kleiner	$3.50	3,150	$480	11.66	1
Miles-Jackson	$4.00-$4.25	6,000	$750	21-25	1-3
Sherman	$7.00	9,550	$750	50	6

(Continued on next page)

Representative Field Prices in the United States and Canada 1956 (Continued)

Area and field—	Footage price	Contract depth (ft.)	Day-work rate	Days on footage	Days on day work
TEXAS GULF COAST					
Danbury Dome	$3.00	3,600	$650	8	3
Liberty, South	$5.90	12,000	$1,050		
Olivia	$2.90	8,430	$750	6	33
Pierce Junction	$3.00	7,127	$750		
NORTH LOUISIANA					
Colquitt (Smackover)	$8.25	10,000	$800		
SOUTH LOUISIANA					
Anse La Butte	$4.25	8,200	$900	20	5
Grand Isle Block 18		10,000			60
Little Pecan Lake	$6.25	13,000	$1,575-$1,650	82	38
ARK-LA-TEX					
Greenwood-Waskom	$7.00	8,600	$850	49	7
Haynes	$4.00	6,000	$750	20	2
Red Rock, East		11,000		88	12
OKLAHOMA					
Cherokee Trend	$3.50	4,900	$725	14	1
Eola	$17.00	10,200	$940		*127
Falls, Northeast		7,200	$650	20	2
Hugoton (Deep)	$5.00	6,812	$600	29	4
Harper County	$5.70	7,500	$720	60	5
Madill, North	$9.50	6,535	$750	60	3
Laverne	$5.75	4,200-7,000	$720	30	5
Short Junction	$4.00	8,200	$650	20	5
Golden Trend:					
North Lindsay-Bromide	$7.00	11,000	$1,000	65	12
Deese Hart	$4.35	8,100	$750-$850	30	5
Southeast Doyne	$7.75	8,000	$750-$800	60	5
KANSAS					
Eastern Kansas (El Dorado, etc.)	$2.55	2,800	$400	8	4
Holley	$3.00	4,000	$550	9	1
Interstate	$3.45	4,650	$480	34	3
Larned	$3.45	3,867	$550	8.66	1.33
Western Kansas (Arbuckle)	$2.85	3,500	$450	12	1
CALIFORNIA					
Bandini		5,890	$41 per hr.		26
Santa Fe Springs	$7.00-$8.00	9,100	$720	45	15
CANADA					
Coleville	$2.75	2,750	$850	5	0
Fort St. John	$15.00	4,900	$38 per hr.	25	5
Harmattan		9,170		42	4
Pambina	$4.00	5,095	$33.50 per hr.	9.25	1.25
Steelman	$4.00-$4.25	4,800	$35 per hr.	14	6
Virden-Roselea	$3.75-$4.00	2,070	$33 per hr.	4-7	3-4.5

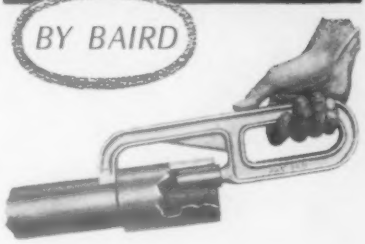
*Wells all day work.

ing time has been reduced considerably. At Dora Roberts trend, the 13,200-ft. Ellenburger wells are now completed in under 70 days if conditions are favorable. In 1951, deep Ellenburger field wells took 120-150 days to drill, and these deep wells were the exception in West Texas. Today, deep Ellenburger wells are commonplace.

Competition for bids has been especially keen in West Texas with the large number of rigs available. Undoubtedly, some contractors are sacrificing depreciation and even profit to keep their rigs busy. This, of course, puts a heavy burden on the man who includes these factors in his bidding, since he will invariably lose out on the contract. This practice of low bidding accounts, at least in part, for the decrease in footage prices during the past 5 years, not only in West Texas but over the entire country.

TUBING GRIPPER

BY BAIRD



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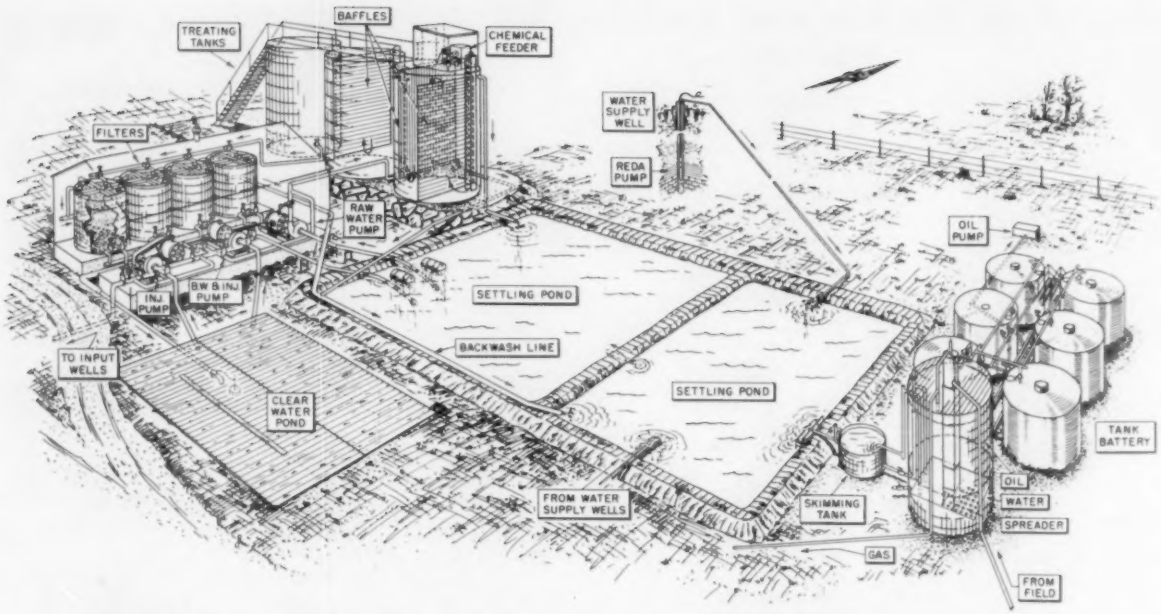


WATER-TREATING PLANT of Morrison Producing Co., Haggert lease, Fox-Bush project, Butler County, Kansas.

Water Flooding in Butler and Greenwood Counties—5

Morris Producing Co.'s Fox-Bush Project

by J. P. Powell

THIS water-flood project covers 990 acres, producing from the Bartlesville sand at 2,800 ft. The oil pay has average thickness of 36 ft., with average porosity of 16 per cent, permeability of 130 md., oil saturation of 75 per cent, and water saturation of 44 per cent.

During the first 4 years of water injection, an aquifer at a depth of 300 ft. was the only source of brine. In 1947, a well was completed in the Arbuckle limestone formation to supplement this supply. The Arbuckle brine was satisfactory, but unnecessary, after abandonment of some input wells on the Bush lease and the adoption of new completion and development practices on other leases reduced the supply-water requirements. Pumping of water from the shallow wells is more economical. The Arbuckle well now is maintained on a standby basis.

In 1953, a second plant was constructed, and four additional supply wells were completed in the shallow water sand with 7-in. casing set and cemented to the surface. The water-bearing formation which is about 10 ft. thick (known locally as the Wreford

Author is petroleum engineer, U. S. Bureau of Mines, Bartlesville, Okla. Data from USBM information circular.

PRODUCING

MINERAL ANALYSES OF FLOODING WATERS, MORRISON PRODUCING CO., FOX-BUSH PROJECT, BUTLER COUNTY, KANSAS

	Supply well		Produced brine		Mixed brine, untreated		Clear water	
Radical—	P.p.m.	Reacting values, in per cent (Palmer)	P.p.m.	Reacting values, in per cent (Palmer)	P.p.m.	Reacting values, in per cent (Palmer)	P.p.m.	Reacting values, in per cent (Palmer)
Calcium (Ca)	102	3.26	6,110	7.68	5,450	7.30	5,570	7.48
Magnesium (Mg)	96	5.06	1,950	4.33	1,740	4.12	1,800	4.27
Sodium (Na)	1,500	41.68	34,700	37.99	33,100	38.58	32,000	38.25
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Bicarbonate (HCO_3)	420	4.41	104	0.04	114	0.05	109	0.05
Sulfate (SO_4)	300	4.00	429	0.22	558	0.31	553	0.31
Chloride (Cl)	2,300	41.59	70,000	49.74	65,600	49.64	65,400	49.64
Total solids	4,718	100.00	113,293	100.00	106,562	100.00	105,432	100.00
Hydrogen sulfide (H_2S)	None		None		None		None	
Barium (Ba)	None		None		None		None	
Specific gravity	1.007		1.082		1.077		1.077	

sandy lime) was acidized with 1,000 to 1,200 gal. of hydrochloric acid. A 3-hp. Reda submersible pump in each well forces the water to the surface and thence to a settling pond. These wells are spaced at wide intervals along the shoestring, each with a daily capacity of 800 to 900 bbl. of water. They are used also to supply water for the drilling rigs. Brine produced with oil also is used for flooding.

Two water-treating plants serve the project, one on the Haggert lease in 1-28s-5e, and the other on the A. E. Fox lease in 13-28s-5e. The two plants are similar but the Haggert plant (the newer and more modern) will be described in detail.

Treating operation . . . The sketch is of the Haggert plant. The water from the tank battery is collected in a 100-bbl. wooden tank, where any oil that might have been carried through from the gun barrel is skimmed off.

From the skimming tank the water flows over an aerating platform and falls into the settling pond to be mixed with the water from the supply wells. The earthen settling pond, which is lined with an asphaltic material to prevent seepage, is 150 by 85 ft., and is divided into two parts by an earthen baffle through which the water flows in two 10-in. conduits. Water in the settling pond enters a 4-in. floating suction line, and a 3 by 4-in. centrifugal pump powered by a 7½-hp. electric motor forces it into the first of a series of three wooden 500-bbl. treating tanks.

Clear water . . . The water enters the treating tank at the top of a flume that extends almost to the bottom of the tank. A chemical mixture is added and mixed with the water. The treated water flows over and then under other baffles in the tank before flowing to the second tank. The second tank is provided with a single baffle under which the water passes before rising to overflow into the third tank. The third tank is not equipped with baffles. From it the water flows to four open rapid-sand filters. Sludge is removed through a line to the settling pond.

The filters are wooden tanks filled with graded gravel and filter sand. Troughs in the form of a cross at the top of each filter provide for the even distribution of the incoming water and for the collection of the backwash water. A perforated collector ring provides for the even flow of water from the bottom of each filter to the clear-water pond (an earthen pit approximately 30 by 30 ft. by 6 ft. deep). It is lined with asphalt membrane to prevent seepage and covered to prevent contamination from dust and debris.

Each filter is equipped with a float that regulates the flow of water to the unit and an overflow line to carry the backwash water to the settling pond. Two centrifugal pumps connected in series force the water from the clear-water pond into the distribution lines at a pressure of 60 psi. However, the piping is arranged to permit one pump to be used for backwashing the filters.

To provide for greater flexibility of operation, the Haggert and Fox tank batteries are interconnected, and the two plants discharge treated water into a main distribution line.

An arrangement of floats and electrodes in the ponds and tanks provides for the automatic operation of the treating and pumping system.

Analyses of samples of the untreated and treated brines are shown in the table.

ON THE JOB . . . . . IN THE FIELDS

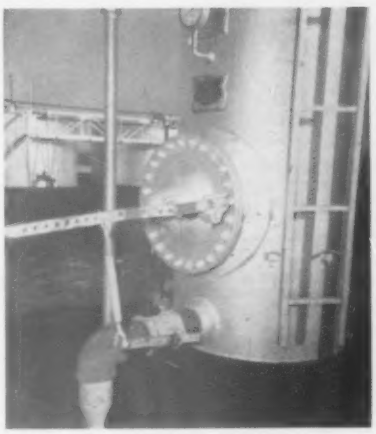
Mud-line valve makes good butterfly valve

WHERE corrosive crudes are likely to cause double-seated dump valves on the separator to hang up, a ceramic-coated butterfly valve usually used on mud lines will solve the problem.

This has been used successfully by Duard Simmons, pumper for Nolan & Thomas Co., Monument field, New Mexico.

The value was installed by placing an L where the dump valve is usually located and by placing the butterfly valve between two short nipples as shown in the illustration. The lever on the float of the separator is then bent to fit the turnbuckle which is connected to the lever on the valve.

No hangup . . . By having only one opening and no close tolerances, the valve cannot hang up and cause crude to be carried into the gas line or gas to be taken into the stock tanks.



Simmons is using the valves on all his separators and the offset operators are beginning to convert to them.

Car bumper opens this swinging gate

A SIMPLE swinging gate which is operated by the bumper of the car may be made by hanging a double gate on a center pole. The gate can be hung with wire cables.

When pushed by the car bumper, the gate swings open and enough inertia is provided to make the gate stay open as the car is driven through.

The gate is made twice the width of the roadway with 2-in. pipe as the frame and crossmembers. Planks are placed on the bottom of the fence with the crossmembers placed on the backs of the planks. The bumpers touch only the wooden part of the gate.

The center crossmember extends down into a concrete well so the gate pivots freely in the middle. Just behind the pivot, a 20-ft. pole is firmly cemented to hold the gate in place.

A cable fastened to the middle of each side of the gate then is wrapped partly around the top of the pole. The cables take all the weight of the gate.

When the gate is pushed open, the movement causes the cables to wind up and when they unwind the gate closes. When properly designed, the gate will swing open when bumped which allows the car to pass. Then, the gate closes without help from the driver of the car. This makes a tight seal against cattle.

METAL SECTIONS, cable, and canvas lining can be hauled to the well site in a small truck.

COMPLETED TANKS can be assembled by two men in 3 or 4 hours. Large quantities of water can be stored at the well location.

Expendable polyethylene forms aboveground water tank

A NEW and convenient way of storing large quantities of water above the ground on oil and gas-well locations is this method developed by Dowell Incorporated at Tulsa.

Sections of expanded metal about 8 ft. long are bolted together to form a circular fence about 4 ft. high. Then, expendable polyethylene film is used to line the expanded metal to form a large aboveground tank.

Holds water . . . Polyethylene film, only 0.003 in. thick, successfully holds the water when supported this way. It also has been used for holding water in earthen pits.

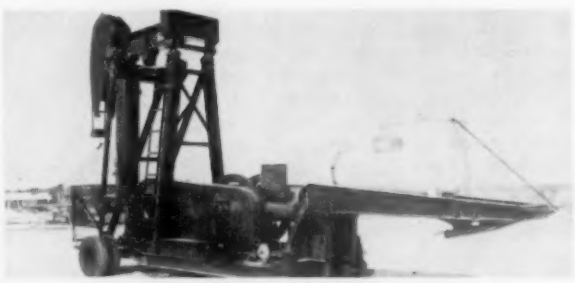
The new type of tank can be used anyplace, even in rocky areas where pits are impossible to excavate or where other circumstances do not permit bulldozing.

The storage tanks are constructed easily. As many as 22 sections of expanded metal along with cable and canvas lining which prevents rupture of the polyethylene film can be hauled to the well site by a small truck.

Complete tanks can be assembled by two men and be ready for filling in 3 or 4 hours.

Metal sections . . . Expanded metal sections will permit variations in storage sizes. Tank sizes and capacities can be regulated by reducing or increasing the number of sections, thus reducing or increasing diameter size. The present limit to the tank is 50,000 gal.

PUMPING UNIT is in place ready for the test.



STANDARD pivoting-wheel hitch hooks to truck.

Portable pumping unit saves testing time

A TRAILER-MOUNTED pumping unit is used by Humble Oil & Refining Co. in New Mexico to test wells before they are placed on permanent production. This allows a well to be completed without the use of swabs and placed on the pump for a test in a matter of an hour's work.

As shown in the illustration, the large drilling rig has been skidded off and a small well-servicing unit is working on the well. As soon as the rods are run, the pumping unit is rolled in place, blocked up, and put to work.

Truck hitch . . . The other view shows the unit ready to be hooked to a transport truck by a standard pivoting-wheel hitch. With the air-balanced unit, it is not necessary to carry counterbalance weights. The air chamber can be adjusted for correct balance in any depth of well.

by Kenneth L. Austin
Datics Corporation

How Electronic Computers Operate—1

SINCE the invention of arithmetic systems, man has been developing calculating devices to reduce the drudgery, eliminate errors, and increase the speed of number manipulation. Such aids, in fact, predate formalized systems; primitive sheep barons used piles of rocks, each rock representing a sheep sent to summer pasture, to determine their losses to robbers and wolves.

Early computing aids included the proportional compass, the abacus, napiers' rods, sector compasses, and the slide rule. In 1642, 16-year-old Blaise Pascal invented the first calculating machine.

The principle of this invention is now quite familiar. Wheels with gear teeth were used and when one wheel was rotated once, the next higher wheel was turned one-tenth of a revolution. Present-day computers are improved versions of Pascal's basic invention.

Computing engine . . . The most significant development in digital calculating devices is attributed to Charles Babbage, an Englishman. He worked from 1820 until 1856 attempting to construct a computing engine. Unfortunately, Babbage preceded by 130 years the technology necessary to give reality to his invention.

It was not until World War II that universities, supported by government and industry, pioneered in the actual construction of the first practical computer. The aircraft industry demonstrated the commercial practicality of its use.

All computing equipment belongs to one of two great classes: analogue and digital. The analogue computer is almost explained by its name. Natural processes are combined, either in dynamic or static union, to form an exact or near-exact analogy to the problem under study.

For example: a water-distribution network may be studied by constructing an analogous electrical network which relates water flow to current, pressure to potential, etc. The effects of parameters on this system can then be determined for a relatively small cost and at great speed.

Even mathematical operations such as multiplication or differentiation may be performed by the manipulation of electrical currents, resistances, and shaft locations. The first completely integrated computing machine, V. Bush's differential analyzer, was this type.

An analogue computer usually produces results as a continuous curve. It is impossible to know exactly how accurate these results are, but they are rarely better than 99 per cent accurate.

The digital computer represents numbers as an aggregate of digits. All results are finite and may be accurate to any desired degree. A digital computing system consists of a desk calculator with a built-in operator . . . represented by electronic or electromechanical devices.

Digital-computer systems are classified as general purpose and special purpose, with subclasses such as internally programed and externally programed. Since the general purpose internally programed, electronic digital computing system is now in wide use, we will confine our remarks to this type.

A digital-computing system can be separated into five sections, with respect to both operations and hardware: The arithmetic unit, automatic-control, memory or storage, input, and output. A direct comparison, section for section, between this system and a system consisting of a desk calculator and an operator can be drawn to explain the function of each section.

The Arithmetic Unit

This unit is nothing more than an electronic desk calculator. Fundamentally, all arithmetic operations are forms of addition: subtraction is the addition of complemented numbers, multiplication is successive addition, and division is successive negative addition. Speeds of 500 to 500,000 arithmetic operations (8 to 10 digit numbers) per second are possible with present-day equipment.

Automatic control . . . The control unit of a computing system causes the computer to perform the desired operations on selected data in a predetermined sequence. The sequence of operations is determined by a set of instructions, stored as numbers in the memory of the equipment in the same form as other data.

One of the most important characteristics of the control units of modern electronic computing equipment is its ability to select the next instruction dependent on the result of the previous computation obtained by the machine itself. Control, of course, corresponds to the desk calculator operator.

Memory or storage . . . The desk-calculator operator uses scratch paper and ruled forms to record instructions, initial data, intermediate and final results. The computing system incorporates such devices as magnetic drums, cores, wire or tape, electrostatic tubes, acoustical delay lines, and electrical relays for the same purpose.

Two or three different types of memory may be used as storage in one system. The electronic machine can read or write numbers at rates varying from 1 to 100,000 ten-digit numbers per second.

Input . . . An engineer with a problem to solve will write the instructions and initial data on paper and give them to the desk-calculator operator. The difference, when working with a machine, is in the media used. A completely satisfactory method of electronically reading hand-written or typed characters has not been developed. Such devices will probably be available in the near future. Punched cards are the most popular input media. Magnetic tape, punched paper tape, magnetic wire, and manually operated keyboards also are used for communication with computing systems.

Output . . . All types of communication available to the desk-calculator operator are also utilized with computing systems with the exception of unintelligible handwriting. Results are displayed as typewritten pages, plotted curves, photographed characters, or control pulses.

Desk methods and automatic-computing systems parallel each other in every respect except cost. Automatic systems may cost as much as $2,000,000 or as little as $3,000. The extra money buys speed. In any case, one computing system can perform as much work as a combination of 1,000 desk calculators and 1,000 operators.

by Dave Vondy
Constructive Engineering Co.

EQUIPMENT DESIGN AND OPERATION

SPHERICAL PROCESS VESSELS—4 PART 1

Spherical Design Is Ideal for Booster Vessels

ALTHOUGH separating particles reach their terminal velocity almost instantaneously, often a transition zone sets up in the vessel, especially so in the case of emulsions. This significantly reduces the effective separation volume.

Because of the limited vertical height of horizontal vessels, the length is increased to add a factor of safety (one design method). Increasing the diameter of a sphere increases the cross-sectional area and also the effective vertical height with the net effect of significantly increasing the effective volume. But, this is not increased in the same manner as increasing one or both dimensions of a cylindrical vessel. It also increases the vessel cost more than a similar change of one dimension in either of the other designs.

Advantage . . . Spherical design shows an interesting advantage in the case of liquid pumping units (often called booster vessels or blow cases). High-pressure gas is used to transfer liquid from a low-pressure source to a higher pressure line.

Gas is alternately introduced into and exhausted from the vessel while the liquid flows through check or switching valves. This method of pumping is of course very wasteful of the energy available in the gas but is used to advantage in remote locations where waste gas is available at sufficient pressure and where the tail gas can be used or as a safety measure.

Often poor design or operation results in waste of more than half of the gas used. Most efficient operation is realized when the vessel is allowed to fill nearly full of liquid thereby reducing the dead or waste-gas space to a minimum.

Less space . . . A spherical vessel can be operated with less waste-gas space than any other design so if the first cost is competitive this design is the most practical.

Compressor inlets, interstage, and afterscrubbers have been built in most every conceivable shape. Requirements vary widely. Although the interstage and afterscrubbers have low and constant liquid loading requirements, the inlet scrubber often must be sized to handle a considerable amount of liquid to protect the compressor. Primary considerations include: prevention of compressor cylinders from receiving a load of liquid, safety shutdown of the compressor in the event of trouble or equipment failure, and dampening pulsations.

A large per cent of the smaller compressors installed are skid mounted in a shop prior to installation and in the usual case no extra space on the skid can be justified for the scrubbers; they must be worked into the unit.

Vertical vessels are too tall to fit under the compressor cylinders and often vibrate excessively. Horizontal vessels often are relatively expensive and also must be set in a nearly inaccessible location. Often, but certainly not always, spherical vessels can be used to advantage.

Scrubber location . . . On many skids, the scrubbers (excepting the inlet scrubber) can be located below and between cylinders and set sufficiently close to serve as effective pulsation dampener bottles, and a more efficient mist-extractor element than is commonly used can be incorporated in the spherical vessel because of its concentrated volume.

Disadvantages

The most serious disadvantage of spherical vessels is the poor availability of hemispherical heads. Heads of certain sizes and thicknesses are used in large quantities and are available from stock but many are not. Also the mills do not have a wide variety of the dies required for pressing. Definite improvement is seen due to increasing use but stock cannot be expected to approach the more common elliptical and dished heads.

Equipment selection . . . Space required for installation is a significant factor to be considered in selecting equipment for location on platforms for offshore or swamp sites and for packaging equipment.

In general, the vertical vessel requires the least space while spherical and horizontal vessels require about the same amount with the spherical having a slight edge. An exception is that case where spherical vessels can be set to advantage on a triangular layout. Both horizontal and spherical vessels have been mounted one above the other, but the advantage gained must offset the inflexibility.

The special design required for the new vessels is a complicating factor. Reliable capacity data is not readily available and for special requirements the designer must rely on meager useful information. The mechanical designer is faced with problems of baffling and location of auxiliary equipment which critically influence the performance of the vessel. Any new application brings new problems along this line. In many instances special or unusual material and auxiliary equipment is required.

Limitations . . . Certain limitations restrict the use of hemispherical heads ruling out the fabrication of spheres in favor of cylinders. Small low-pressure hemispheres having a thickness below ¼ or ⅜ in. cannot be used in construction to compete with pipe unless future mass production changes this picture.

Large high-pressure hemispherical heads cannot be pressed. Large vessels, which must be made from many pieces because the heads cannot be pressed in one piece, require a considerable amount of welding and also present a complex automatic-welding problem. Of course there is little question but that demand will force a supply of at least some of these larger heads.

A vessel which is to be used for liquid measurement such as a calibration or test tank (not including pressure storage) should be vertical so that the capacity per unit height remains constant. Like the horizontal, the spherical vessel is not a practical selection.

by W. L. Nelson
Technical Editor

COST-imating

Costs Have Been Rising Sharply

SINCE May 1956, all indexes on this page have risen except those for lumber and for valves and fittings. Between May and August the average rise has been 2.4 per cent, the Nelson Refinery Construction Cost Index has risen by 2.9 per cent, and the approximate increase in steel prices was 6.1 per cent. Thus, additional increases in the cost of other than steel items is to be expected. No such general increase has occurred since this page was established.

The cost indexes on this page may be used to convert prices known at any date, to prices at other dates or the present, by ratios of the cost indexes of the same dates. Similar Itemized Cost Indexes are published quarterly in the first weekly issues of January, April, July, and October. Actual prices for most of the items shown on this page were published in The Oil and Gas Journal issues of April 11, 1955, page 132; July 4, 1955, page 122; and October 3, 1955, page 145. In addition, the Nelson Refinery Construction Cost Index is published in the first issue each month.

Itemized Cost Indexes

(Multiply the 1946 prices of the Cost-imating Series by these Index Numbers divided by 100)

	1948	1950	1952	1954	1955	Aug. 1956	References*	Index for earlier years (The Oil and Gas Journal) in Cost-imating issues
Labor:								
Skilled construction	125.0	140.0	157.9	174.6	179.8	189.5	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	131.0	148.1	168.2	192.1	199.4	212.2	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	128.0	144.0	163.1	183.3	189.6	200.9		No. 61—Dec. 15, 1949
Refinery operation	126.0	137.6	155.1	169.5	176.7	189.8	Sur. of current business	No. 55—Nov. 3, 1949
Refinery productivity, bbl. per employe	109.0	125.0	132.0	142.0	149.0	145.0	Sur. of current business	Sept. 24, 1956§
Equipment or materials:								
Arc-welding machinery			151.3	158.4	163.8	183.1	Code ‡11-76	May 2, 1955§
Boilers, tanks, and sheet metal	†140.0	†136.0	†153.4	147.3	150.3	170.1	Code 10-72	April 21, 1952§
Boiler tubes, 2-2¼ in.	131.3	149.5	168.8	199.4	211.2	250.7	Code 10-14-61	Sept. 5, 1955§
Building materials (nonmetallic)	120.6	127.0	134.8	143.6	149.4	155.4	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	122.8	132.5	140.6	144.7	150.5	160.3	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	133.3	153.4	167.1	193.1	205.9	223.6	Code 13-42	May 30, 1955§
Castings (foundry products)	144.6	152.9	168.0	181.1	185.1	204.3	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	121.3	134.6	145.8	159.1	167.4	179.4	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	119.4	125.3	132.7	142.1	146.6	153.4	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	118.9	124.4	132.6	138.5	139.8	145.5	Code 13-3	
Electrical machinery	127.6	134.9	152.4	159.9	162.5	175.0	Code ‡11-7	May 2, 1955§
Motors and generators	128.6	135.0	154.6	157.7	157.1	170.5	Code ‡11-73	No. 31—May 19, 1949
Switchgear			161.4	171.2	176.5	194.9	Code ‡11-75	May 2, 1955§
Transformers	127.0	131.6	148.0	161.9	161.8	176.6	Code ‡11-74	No. 31—May 19, 1949
Engines (composite)	116.0	126.0	146.5	150.5	153.2	163.6	Code ‡11-54	No. 36—June 23, 1949
Exchangers	130.0	140.0	165.8	174.5	156.8	197.8	Manufacturer	No. 2—Oct. 28, 1948
Fans and blowers	131.3	162.9	183.7	192.6	199.7	229.5	Code 11-47	Feb. 17, 1949§
Hand tools	125.2	143.2	155.1	173.8	185.7	202.8	Code 10-42	June 27, 1955§
Instruments (composite)	120.0	127.8	146.2	154.6	162.9	181.9	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)		114.0	132.3	161.6	177.2	203.3	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)		138.5	160.5	179.6	188.6	203.1	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)		135.5	155.2	146.5	153.5	170.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, six-point		134.0	151.5	167.2	178.6	208.3	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control		134.1	144.9	150.5	164.0	190.2	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder		135.6	158.4	166.3	169.1	187.1	Manufacturer	No. 34—June 9, 1949
Pressure gage		101.2	108.6	108.6	112.1	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)		124.0	149.4	152.8	156.5	170.2	Manufacturer	No. 34—June 9, 1949
Control valve		133.3	155.5	162.0	166.8	185.5	Manufacturer	No. 34—June 9, 1949
Insulation materials	126.8	125.0	130.4	135.5	131.8	124.7	Code 13-72	
Lumber (composite)	181.0	193.0	203.2	197.8	209.7	214.3	Code 8-1	No. 7—Dec. 2, 1948
Southern Pine	174.3	176.9	191.2	181.2	188.4	195.0	Code 8-12	No. 7—Dec. 2, 1948
Other soft woods	206.5	230.2	248.5	252.7	265.1	266.5	Code 8-13	
Machinery—general purposes	124.9	136.7	151.8	159.9	166.8	185.9	Code 11-4	Feb. 17, 1949§
Machinery—construction	127.8	140.1	157.5	165.9	172.5	188.4	Code 11-2	
Machinery—oil field	†125.9	†135.8	†149.9	†161.9	†168.5	178.9	Code 11-51	Oct. 10, 1955§
Paints—prepared	141.4	140.0	155.7	159.0	161.4	167.9	Code 6-21	May 16, 1955§
Pipe, sewer	110.9	120.7	136.9	140.1	149.9	160.4	Code 13-45	No. 22—Mar. 17, 1949
Pipe, black iron	141.0	160.0	179.0	195.0	204.0	243.7	Code 10-14-56	
Pumps, air compressors, etc.	127.0	138.2	155.6	166.5	177.2	196.6	Code ‡11-41	No. 29—May 5, 1949
Steel (iron and steel)	141.1	152.9	168.5	179.6	189.9	214.9	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	135.7	153.7	170.0	187.1	196.0	220.9	Code 10-14	July 25, 1955§
Plate and sheet			(See boilers, tanks, etc., above)					
Structural shapes	145.0	162.7	176.2	193.4	204.3	229.3	Code ‡10-14-31	No. 18—Feb. 17, 1949
Valves and fittings	†125.9	†135.8	190.8	197.1	208.6	231.3	Code ‡11-49 (1-6 & 11-14)	No. 46—Sept. 1, 1949
Nelson Refinery Construction	132.5	146.2	163.6	179.8	184.2	198.8		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology, The Oil and Gas Journal.

by W. L. Nelson
Technical Editor

COST-imating

24. Cost of Treating and Cooling Equipment

COST INDEXES (1946 = 100)

	Redwood heart, all clear*	Cypress select C†	Wages, carpenters‡	Cooling tower¶	Nelson index§
1946	100	100	100	100	100.0
1947	126	155	118	129	117.0
1948	150	178	130	148	132.5
1949	163	213	131	159	135.7
1950	192	250	137	179	146.2
1951	202	256	147	188	157.2
1952	223	206	150	182	163.6
1953	229	208	159	189	173.5
1954	230	204	170	193	179.8
1955	245	208	173	200	184.2
1956 estimate	....	....	....	....	195.6

*1946 base price, $104 per M.b.f. †1946 base price, $99.10 per M.b.f. ‡Index based on New York wages of $2.10 in 1946. §The Nelson Refinery Construction Cost Index, The Oil and Gas Journal, July 7, 1952, page 105. The index also appears in the first issue each month and in addition, indexes of individual items of equipment are published in the first issues of the months of January, April, July, and October. ¶To be used herein. Based on 25 per cent each redwood and cypress lumber and 50 per cent carpentry labor.

The basic or equivalent costs of induced-draft cooling towers for the year 1946 were:

15° F. cooling range—$4.35 per g.p.m.
20° F. cooling range—$5.00 per g.p.m.
30° F. cooling range—$6.00 per g.p.m.

These costs may be converted to current costs by means of a cost index for cooling towers such as the one indicated on this page. The price of redwood and cypress lumber and labor may be obtained from the quarterly issues (first issues in January, April, July, and October) of Cost-imating in The Oil and Gas Journal. The costs must also be corrected for operating conditions as indicated in Fig. 1 (which is a modification of the method of Laubach[3]). The costs apply to towers ranging in capacity from 8,000 to 28,000 g.p.m. (smaller towers cost much more and larger towers slightly less) and they include erection, foundations, basins, and fans but no water pumps or water treatment.

Example—The basic 1946 cost of a tower operating at a wet-bulb temperature of 70° F. with the water going through the range of 100° to 80° F. (approach of 10° F. and cooling range of 20° F.) is:

$5.00 × $0.92 = $4.60 per g.p.m.

During 1955, the cost was about double (see index):

$4.60 × $2.00 = $9.20

A very large tower might cost only $8.10 per g.p.m. whereas a 4,000-g.p.m. tower might cost $14-$15.

The power required for induced-draft towers is indicated in Table 1. The natural-draft towers used so extensively in Europe, cost 68-78 per cent of induced-draft towers, and conventional atmospheric towers are said to cost about the same as induced-draft towers. The cost of lines, valves, etc., leading to and from the cooling tower is said[9] to be $11-$16 per g.p.m. (1946). Drift loss, as percentage of circulation, is about 10 per cent for spray ponds, 1 per cent for conventional atmospheric towers, and only 0.2 per cent for induced-draft towers.

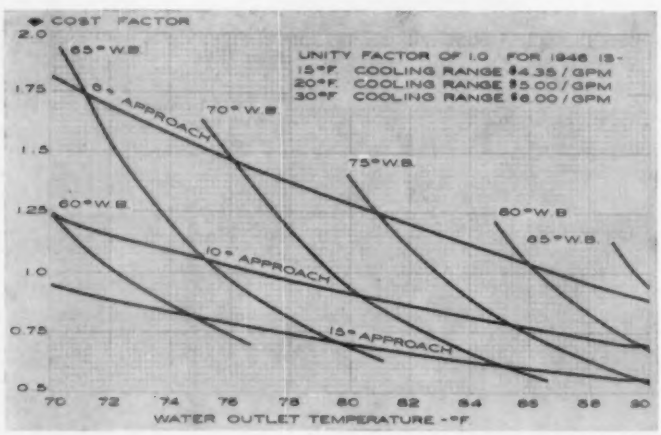


Fig. 1—Approximate relative costs of cooling towers as a function of operating conditions.

TABLE 1—HORSEPOWER PER G.P.M. REQUIRED FOR INDUCED-DRAFT TOWERS

Cooling range	Approach (°F.) of 5	10	15	20
15	0.029	0.022	0.018	0.014
20	0.031	0.024	0.019	0.015
25	0.033	0.025	0.020	0.016
30	0.034	0.026	0.020	....

Table 2 indicates the cost of installed water-treating plants. Agreement was extremely poor, ranging from six major references[1 4 5 6 7 9] as much as minus 150 per cent and plus 100 per cent.

The cost of drilling water wells ranges from about $1.75 per foot at a depth of 300 ft. to about $6.00 per foot at 1,200 ft.

TABLE 2—APPROXIMATE* COST OF COMPLETE INSTALLED WATER TREATING PLANTS, DOLLARS (1946)

Capacity (g.p.m.)	Hot lime	Zeolite	Demineralization
10	....	4,200	....
30	....	9,500	10,000
60	11,000	16,000	18,000
100	17,000	23,500	28,000
200	30,000	39,000	52,000
300	41,000	53,000	73,000
500	62,000	77,000	113,000
700	80,000	98,000	153,000
1,000	108,000	130,000	210,000

*Extremely poor agreement.

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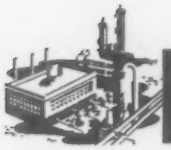


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—75

Why Heat Transfer Interests the Refiner

IN petroleum refining, the proper use of heat is of utmost importance. Successful operation of petroleum processes is largely dependent upon correct heat application. Efficient equipment, designed to take full advantage of processing heat, is in use on all the refining operations. The cost of heat for refining operations is of such magnitude that inefficient handling of heat-transfer problems may well spell the difference between economic and uneconomic operation.

To better understand the conservation of heat, it is necessary that the basic principles of heat transmission be understood. In general, there are only three different methods of heat transmission: (1) convection, (2) conduction, and (3) radiation.

1. Convection . . . All systems of heating and ventilating depend upon what are called convection currents which, in turn, depend upon the expansion of liquids and gases. The explanation of the movement of convection currents is this: that any gas or liquid expands when heated, increases in volume and, consequently, decreases in density.

In a convection current, the lighter fluid is pushed upward by the heavier surrounding fluid, just as a block of wood under water is pushed up by the surrounding water.

Since the rising part of a convection current is warmer than the returning part, there is a transfer of heat from the flame—or other heat source—to the cooler parts of the fluid at the top. This process of transporting heat by carrying hot portions of a fluid from one place to another is called convection.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

A simple experiment is shown in Fig. 1.

When the flame is moved back and forth along the lower portion of the tube, the convection current that has been created can be seen as the water containing sawdust circulates from the lower portion of the bottle, through the tube and back into the bottle.

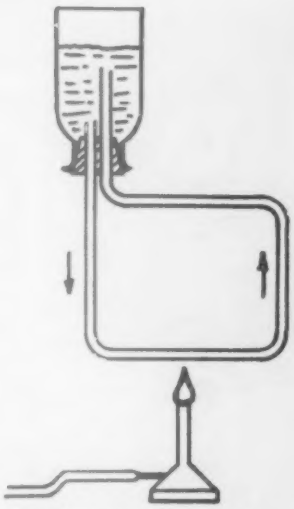
The flame has warmed the water in the tube, causing that portion of the water to expand and decrease in density. The less dense water, like the block of wood, is pushed upward by the surrounding water of greater density. This process continues to take place and thus creates the circulation observed.

If a thermometer were placed in the bottle of water, we would see that a rise in temperature is taking place. This temperature rise is occasioned by the warmer water mixing with the cooler portion and transferring heat through the process known as convection.

It is through this process that the water heater in your home operates. The home water heater is very similar to the experimental apparatus, except that the heat is applied directly to the tank containing the water.

Conduction . . . It has been shown how heat can be transported by making hot fluids flow through pipes. Heat can also be transmitted without moving any material thing —by the two methods called conduction and radiation.

First consider only conduction. Heat that passes from one part of a substance to another part of the same substance or from one substance to another in physical contact with it, without the movement of particles of either substance, is said to flow by conduction. Everyone has had the experience of touching the handle of a silver spoon in hot coffee or soup and have often found the spoon too hot to be lifted from the cup barehanded.

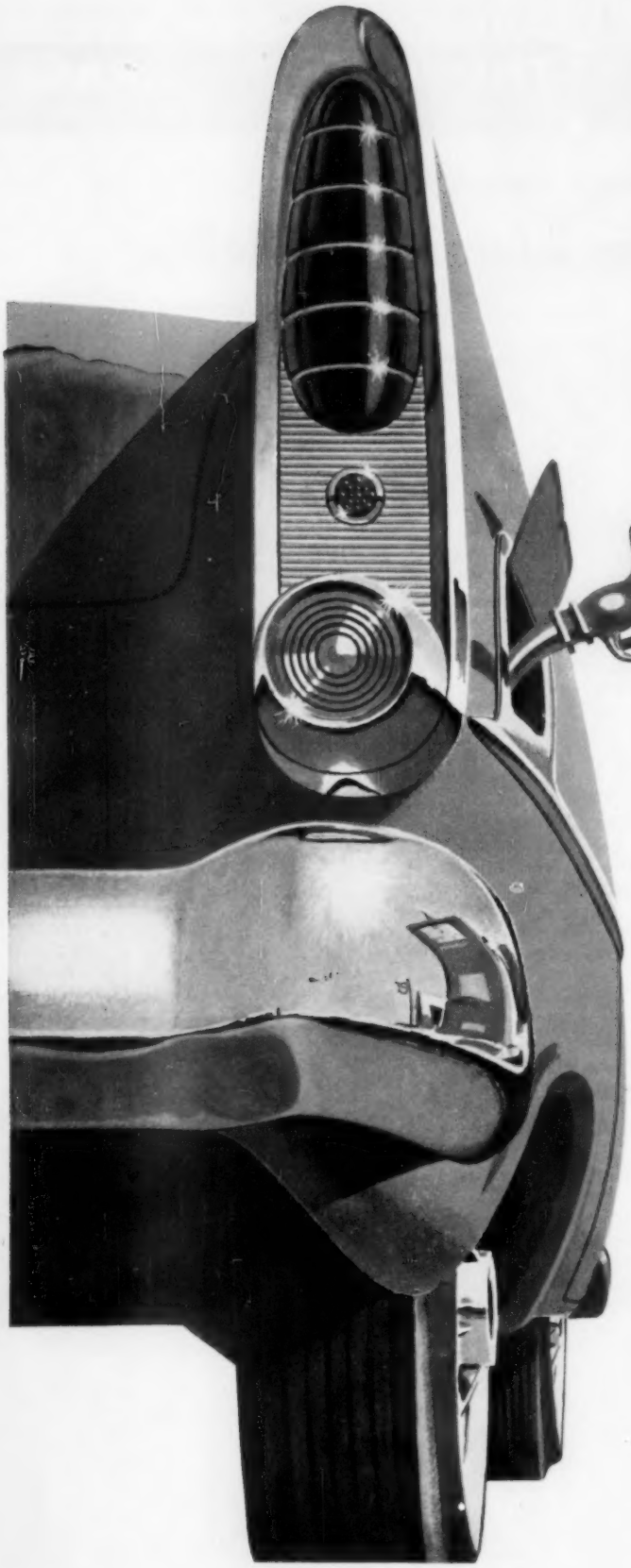


CONVECTION process is shown in this experiment. Fig. 1.

Similarly, the metal handle of a sauce pan becomes extremely hot even though only the bottom of the pan is exposed to a flame. These experiences are examples of heat being transmitted by conduction.

There are some substances, such as stone, wood, wool, and cork, which are poor conductors of heat and are called heat insulators. All metals, such as silver, copper, brass, iron, etc, are good conductors as compared to nonmetals.

Metals vary in their respective abilities to conduct heat. This ability or inability is called conductivity. To use this physical property in making heat-transfer calculations, the property must be in some unit of measure. This unit of measure is called the coefficient of thermal conductivity of the materials.



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PAINTING STEEL—13

Paints Recommended for Interiors

by J. O. Jackson* and Joseph Bigos†

NONCORROSIVE steel buildings such as offices, garages, warehouses, etc., require very little cleaning and priming for protective purposes. Paint system No. 7—a low-cost system not described herein—provides adequate protection against corrosion and is a satisfactory basis for painting provided asphalt-varnish primer is not used.

Asphalt will obviously bleed through decorative topcoats unless a barrier, such as a latex-emulsion paint, is used. Interior conditions are usually sufficiently mild so that rigorous surface preparation on steel plate or trim is not necessary, but the best practical method should be used.

For production items of thin section, such as prefabricated partitions, blast clean or pickle and hot phosphate preferably.

Painting recommendations are given in Table 14.

Table 14—Decorative Painting of Interiors[1]

Primers in paint system No. 1 are best for heavy, poorly cleaned steel such as building columns and bulkheads but paint system No. 7 will generally be adequate for most conditions except for highly humid spaces such as launderies, or corrosive spaces such as battery rooms.

The disadvantage of paint system No. 1 primers are that they dry too slow and too soft. Primers in paint system No. 2 are excellent for interiors of ships, cargo holds, boiler rooms, offices, shops, etc.; quick drying and dry hard.

Finish paints of a fire-retardant value may be advantageous. Those listed here are suitable for interior only.

*Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1955.

Finish paints should be of a pleasing and acceptable color with high reflectivity. See Color in Industrial Plants, Chapter 16, Volume 1.

Low-gloss paints of high reflectivity should be used for walls, ceilings, and partitions.

Semigloss or gloss paints should be used for trim, dado, etc.

Desks, lockers, cabinets, equipment may be finished in bright color of gloss or semigloss, hard alkyd paint by specifying TT-E-489b or TT-E-529.

Use one-coat primer PS7 or PS2. Use PS1 primers on rusty steel but allow to dry hard.

Use one or two finish coats of paint listed in recommendations. Colors may be standard colors of specification or varied to suit the taste.

Fire Retardant Paints

JAN-P-697 . . . light gray, low-gloss, alkyd.

JAN-P-701 . . . light green, semigloss, alkyd.

JAN-P-702 . . . white, semigloss, alkyd.

Formula 124 . . . white, semigloss, chlorinated rubber alkyd.

MIL-P-17970 . . . medical green, semigloss, chlorinated rubber alkyd.

MIL-P-17971 . . . equipment gray, semigloss, chlorinated rubber alkyd.

MIL-P-17972 . . . green gray, semigloss, chlorinated rubber alkyd.

MIL-P-17973 . . . yellow gray, semigloss, chlorinated rubber alkyd.

MIL-P-17133A . . . cream, gloss, chlorinated rubber alkyd.

MIL-E-17134A . . . light gray, gloss, chlorinated rubber alkyd.

MIL-E-17136A . . . beach sand, semigloss, chlorinated rubber alkyd.

MIL-E-17137A . . . red, gloss, chlorinated rubber alkyd.

MIL-E-17138A . . . medium blue, gloss, chlorinated rubber alkyd.

MIL-E-17139A . . . jade green, gloss, chlorinated rubber alkyd.

MIL-E-17140A . . . marine green, semigloss, chlorinated rubber alkyd.

MIL-E-17152A . . . dark oak, gloss, chlorinated rubber alkyd.

MIL-E-17325 . . . rosewood, semigloss, chlorinated rubber alkyd.

MIL-E-17326 . . . clipper blue, semigloss, chlorinated rubber alkyd.

MIL-E-17327 . . . light gray, semigloss, chlorinated rubber alkyd.

MIL-E-17328 . . . cloud gray, semigloss, chlorinated rubber alkyd.

MIL-E-17329 . . . light blue, semigloss, chlorinated rubber alkyd.

MIL-E-17330 . . . sea spray blue, semigloss, chlorinated rubber alkyd.

Conventional Interior Paints

MAP-48 . . . white or tints, flat, alkyd and nonpenetrating.

52MC-120 . . . white or tints, flat to eggshell, olcoresinous, linseed oil.

52MC-107 . . . white or tinted enamel, high gloss, alkyd.

52MC-107 . . . white or tinted enamel, high gloss, alkyd.

TT-P-51d . . . interior wall, white or tints, flat.

TT-E-508 . . . interior wall, white or tints, semigloss.

TT-E-506b . . . interior enamel, white or tints, gloss.

Interior or Exterior Trim or Equipment Paints

TT-E-529 . . . 16 colors, alkyd, semigloss finish paint.

TT-E-489b . . . 36 colors, alkyd, gloss finish.

These paints may be procured in various shades to match color chips from TT-C-495.

Reference

1. Steel Structures Painting Manual.

Editor's note: This installment concludes the series on painting steel.

Part 12

MODERN DRILLING

ROCK-BIT DESIGN, SELECTION, AND EVALUATION

How Bits Are Designed for Hard Formations

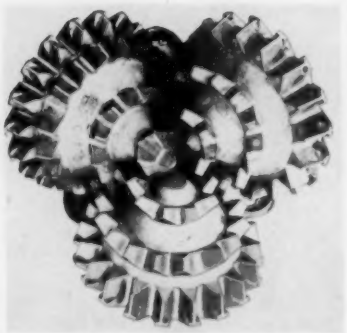
by H. G. Bentson
H. C. Smith Oil Tool Co.

THE F-type bit *(see Part 10, December 10, The Oil and Gas Journal)* is designed for medium-abrasive to hard nonabrasive formations. Although this design has a slightly greater number of teeth than the G type of bit, it is generally classified as being designed for use in formations having slightly higher drillability. The reason for this classification is caused by the difference between the two designs in regard to the amount of gage protection and tooth facing.

The typical G type of bit exemplified by Fig. 23 is designed for use in medium-hard abrasive to hard formations. Except for the omission of deletions and tooth facing and increased gage protection obtained by the reinforced gage surface, this design is identical to that for the D and E types.

Since this formation type is generally drilled with heavy bit weights, the reinforced gage surface is required to reduce extreme wear or breakage of the gage tip. No facing is applied to the teeth in order to eliminate flaking of the material under high impact loads and the chipping and fracturing of the case-hardened tooth surfaces that would result.

Hard formations . . . The H type of three-cone bit is designed to drill formations classified as being hard semiabrasive. The design of this bit is identical to that of the J type of bit with the exception of the gage-surface geometry and the possible addition of tooth facing. Whereas the J type of bit incorporates a web between the teeth for maximum gage protection, the gage surface on the H type of bit is limited to that which is developed by the outer end of the gage teeth.



TYPICAL type G three-cone bit. Fig. 23.

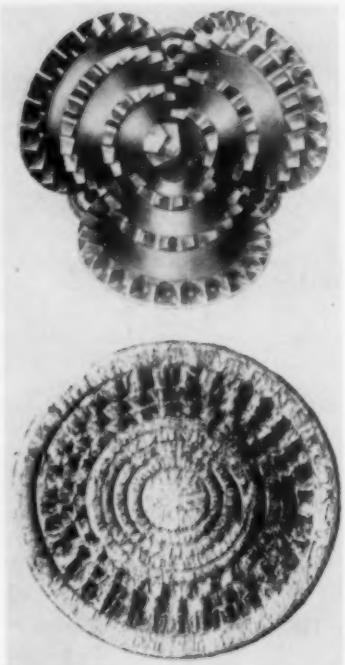
The omission of this web permits improved penetration rates with moderate bit weight in areas where gage wear is not a problem. Tooth facing on the hardfaced type is generally limited to one face in order to minimize chipping and fracturing of the case-hardened surfaces.

A typical J type of three-cone bit designed for the harder abrasive formations is illustrated by Fig. 24. Since this type of formation requires an efficient chipping-crushing action, this design usually incorporates a maximum journal angle, no offset, and minimum variation in the cone-profile angles.

Due to the abrasiveness of the formation and the chipping action of the cone, the teeth are closely spaced to obtain maximum wearing qualities. Additionally, the included angle of the teeth is the largest of all in order to withstand the high impact loading to which they are subjected.

Tooth depth is less than on any of the other types. With the exception of the K type this design affords the greatest gage protection by using a web type of gage surface.

Button bits . . . The K type of three-cone bit is designed for drilling extremely hard, abrasive formations. Due to the high compressive strength of these formations, a maximum chipping-crushing action by the bit



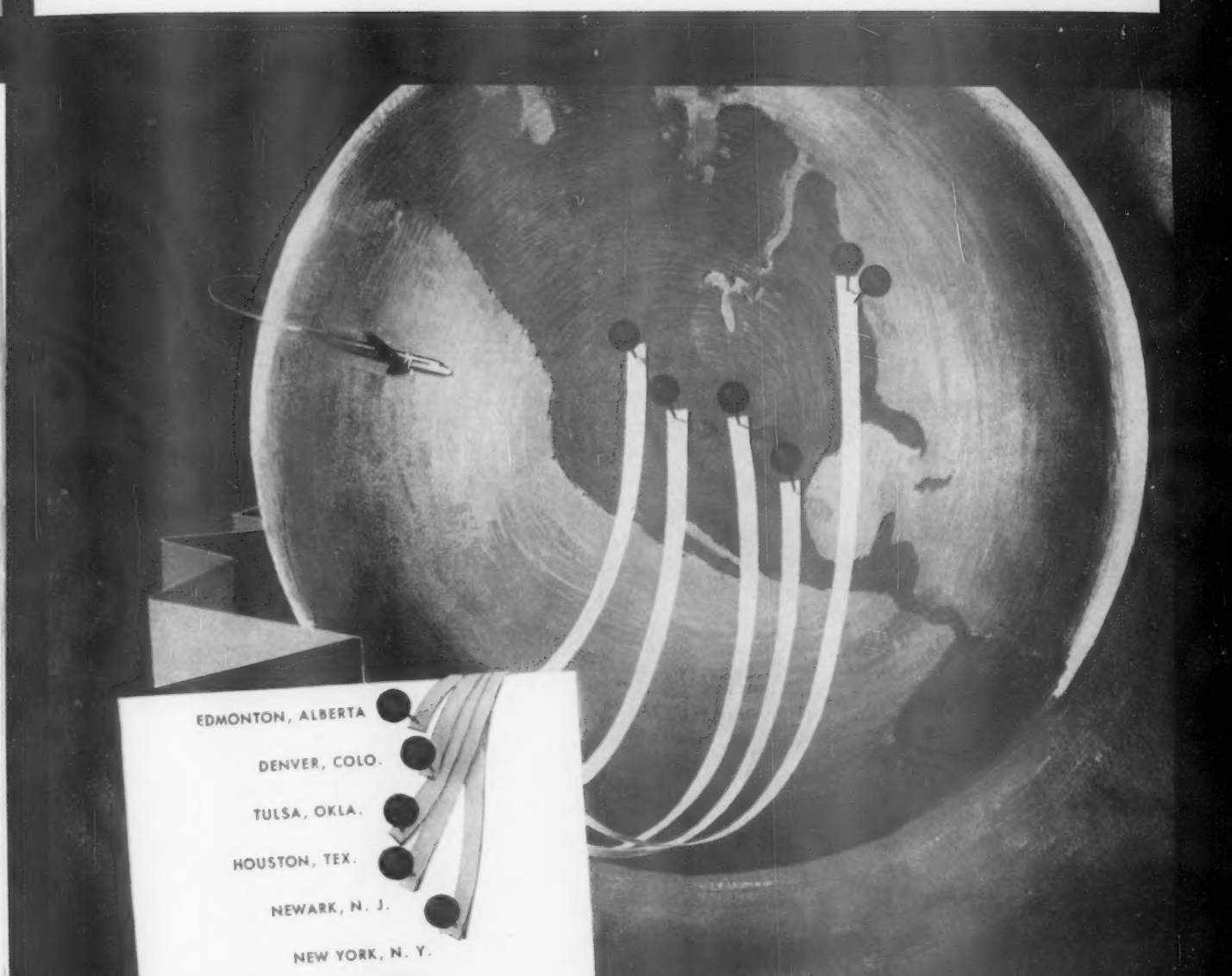
TYPICAL type J three-cone bit and bottom-hole pattern. Fig. 24.

is required for optimum performance. To obtain this action, the rolling characteristics of the cones must approach that of a true roll more closely than those for any of the other bit types.

Since the high compressive strength of the formation restricts tooth penetration and its abrasiveness causes rapid tooth wear, spherical-nosed compacts are used as teeth. These compacts composed of a special grade of sintered tungsten carbide combine the necessary qualities of toughness and abrasion resistance required for satisfactory performance under heavy loads[1].

Reference

1. Payne, L. L., and Chippendale, W., Hard-Rock Drilling, Proc. A.P.I. 33 (4) (1953).



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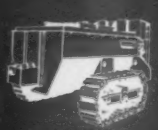

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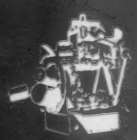

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Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

• **Cape Pipe Line Co.** (organized by Sun Oil Co., Cities Service Co., Atlantic Refining Co.)

Project: Long range plans for line on the lower Delaware Bay to the Philadelphia refining area.

Completion: 1960.

Fulton, R. H. & Co., Lubbock, Tex.

Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.

Status: Fulton, a contractor has applied to Wyoming Public Service Commission.

Humble Pipe Line Co.

Project: 94 miles of 18-in. from its Ector Station near Odessa to its Kemper Station near Big Lake, Tex.

Status: Under way.

Contractor: **Lone Star Constructors,** H. A. (Red) Wylie, superintendent, office at Big Lake.

Completion: Mid-February 1957.

• **Interstate Oil Pipe Line Co.**

Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.

Status: Proposed.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Offshore Gathering Corp.,** Houston.

Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)

Status: Proposed.

• **Pasotex Pipe Line Co.**

Project: 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.

Status: Planned.

Completion: July 1, 1957.

Service Pipe Line Co.

Project: 9 miles of 10-in. and 1 mile of 6-in. to connect Lake Washington field in Plaquemines Parish, Louisiana, with a tank terminal at Port Sulphur on the Mississippi River.

Status: Under way.

Contractor: **Sam Carline, Inc.,** Berwick, La.

Completion: February 1, 1957.

• **Sinclair Pipeline Co.**

Project: 150 miles of 20-in. from Teague, Tex., to Houston.

Status: Planned for 1958.

Completion: 1958.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)

Project: 190 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.

Status: Under way.

Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (owned by The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.)

Project: 515 miles of 16-in. from southeast corner of Utah to Jal in southeastern New Mexico.

Status: Field surveys start January 1957.

Union Oil Co. of California.

Project: 45 miles of 12-in. and 180 miles of 16-in. crude and products line from San Joaquin Valley to its Oleum refinery at Rodeo, Calif.

Status: Under way.

Contractor: Being handled in six sections by various contractors.

Completion: April 1, 1957.

Products Pipelines

• **American Pipe Line Co.**

Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.

Status: Planned.

• **El Paso Natural Gas Co.**

Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.

Status: Planned.

Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.

Status: Planned.

Completion: August 1957.

• **Great Lakes Pipe Line Co.**

Project: 84 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.

Status: Construction scheduled to start spring 1957.

• **Gulf Refining Co.**

Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belview near Houston (368 miles is conversion from crude service).

Status: Under way.

Contractor: **Panama-Williams Corp.** has 46 miles from Waddell Plant to Midland. Remainder not let.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Ohio Oil Co.**

Project: 350-miles of 12-in. from Wood Rivier, Ill. to Chicato.

Status: Planned. Starting date depends on pipe delivery, which may not be completed until 1958.

• **Southern Pacific Pipe Lines, Inc.**

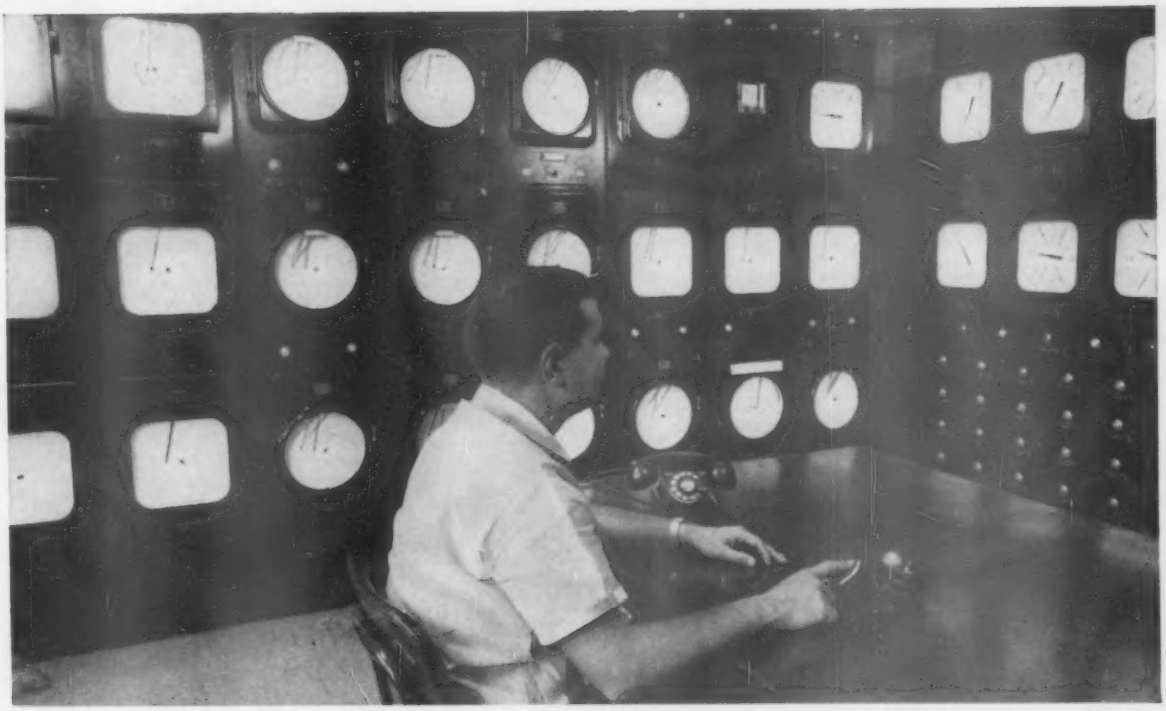
Project: 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.

Status: Preliminary work under way.

Contractor: **River Construction Corp.** has 84 miles of 8, 10-in. from Richmond to Stockton, Calif. to complete late spring 1957, F. O. Traweek, spread superintendent, office at Richmond.

Completion: August 1, 1957.

• **Union Oil Co. of California**



Bell System *selective calling* is used by the dispatcher of Mississippi Valley Gas Co. By flipping a switch, dialing the number of a distant metering point and reading a meter, he knows the pressure, flow and temperature at any of the company's 21 field points.

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J. H. Lambdin, Vice President—Operations, Mississippi Valley Gas Company

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Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

• **Cape Pipe Line Co.** (organized by Sun Oil Co., Cities Service Co., Atlantic Refining Co.)

Project: Long range plans for line on the lower Delaware Bay to the Philadelphia refining area.

Completion: 1960.

Fulton, R. H. & Co., Lubbock, Tex.

Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.

Status: Fulton, a contractor has applied to Wyoming Public Service Commission.

Humble Pipe Line Co.

Project: 94 miles of 18-in. from its Ector Station near Odessa to its Kemper Station near Big Lake, Tex.

Status: Under way.

Contractor: **Lone Star Constructors,** H. A. (Red) Wylie, superintendent, office at Big Lake.

Completion: Mid-February 1957.

• **Interstate Oil Pipe Line Co.**

Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.

Status: Proposed.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Offshore Gathering Corp.,** Houston.

Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)

Status: Proposed.

• **Pasotex Pipe Line Co.**

Project: 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.

Status: Planned.

Completion: July 1, 1957.

Service Pipe Line Co.

Project: 9 miles of 10-in. and 1 mile of 6-in. to connect Lake Washington field in Plaquemines Parish, Louisiana, with a tank terminal at Port Sulphur on the Mississippi River.

Status: Under way.

Contractor: **Sam Carline, Inc.,** Berwick, La.

Completion: February 1, 1957.

• **Sinclair Pipeline Co.**

Project: 150 miles of 20-in. from Teague, Tex., to Houston.

Status: Planned for 1958.

Completion: 1958.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)

Project: 190 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.

Status: Under way.

Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (owned by The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.)

Project: 515 miles of 16-in. from southeast corner of Utah to Jal in southeastern New Mexico.

Status: Field surveys start January 1957.

Union Oil Co. of California.

Project: 45 miles of 12-in. and 180 miles of 16-in. crude and products line from San Joaquin Valley to its Oleum refinery at Rodeo, Calif.

Status: Under way.

Contractor: Being handled in six sections by various contractors.

Completion: April 1, 1957.

Products Pipelines

• **American Pipe Line Co.**

Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.

Status: Planned.

• **El Paso Natural Gas Co.**

Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.

Status: Planned.

Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.

Status: Planned.

Completion: August 1957.

• **Great Lakes Pipe Line Co.**

Project: 84 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.

Status: Construction scheduled to start spring 1957.

• **Gulf Refining Co.**

Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belview near Houston (368 miles is conversion from crude service).

Status: Under way.

Contractor: **Panama-Williams Corp.** has 46 miles from Waddell Plant to Midland. Remainder not let.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Ohio Oil Co.**

Project: 350-miles of 12-in. from Wood Rivier, Ill. to Chicato.

Status: Planned. Starting date depends on pipe delivery, which may not be completed until 1958.

• **Southern Pacific Pipe Lines, Inc.**

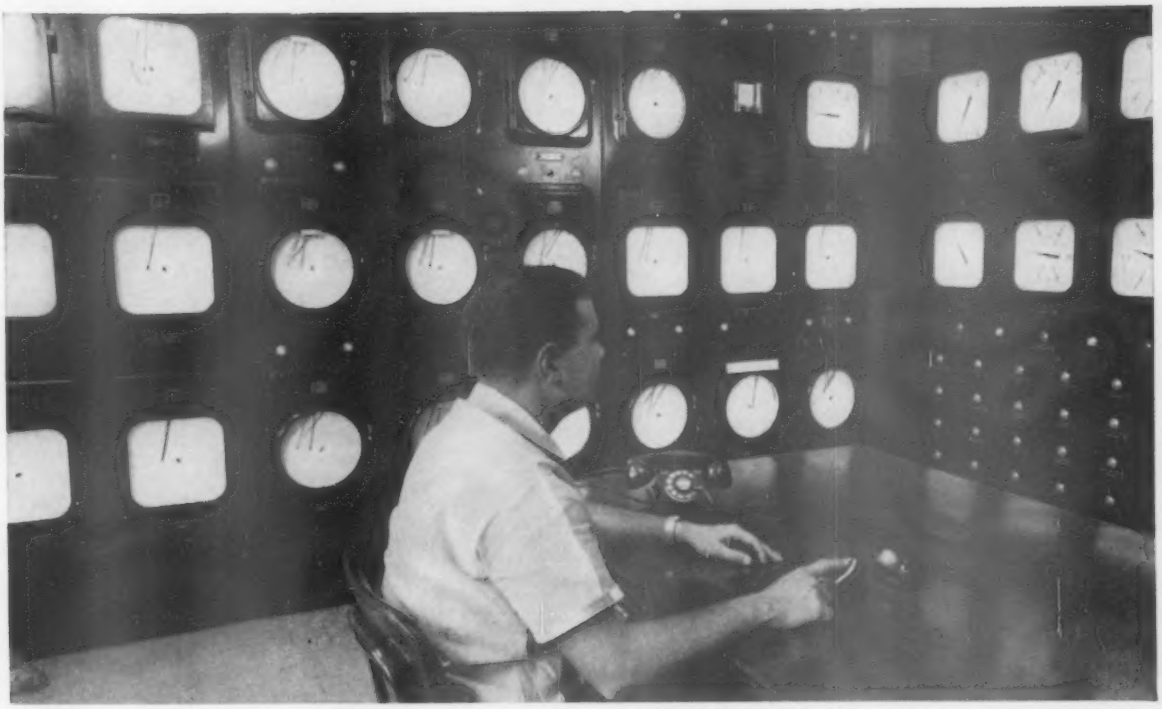
Project: 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.

Status: Preliminary work under way.

Contractor: **River Construction Corp.** has 84 miles of 8, 10-in. from Richmond to Stockton, Calif. to complete late spring 1957, F. O. Traweek, spread superintendent, office at Richmond.

Completion: August 1, 1957.

• **Union Oil Co. of California**



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Pipeline Patrol

Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.
Status: Proposed.
Project: 45 miles of 12-in. and 180 miles of 16-in. crude and products line from San Joaquin Valley to its Oleum refinery at Rodeo, Calif.
Status: Under way.
Contractor: Being handled in six sections by various contractors.
Completion: April 1, 1957.
Project: 14 miles of 8-in. between Rodeo and Richmond, Calif.
Status: Planned.
Completion: February 1957.

• **Yellowstone Pipe Line Co.**
Project: 22 miles of 8-in. near Spokane, Wash.
Status: Planned.
Completion: March 1, 1957.

Non-Petroleum Pipelines

American Gilsonite Co.
Project: 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.
Status: Under way.
Contractor: **Engineers Limited Pipe Line Co.**
Completion: Early 1957.

Natural-Gas Pipelines

• **Arkansas Louisiana Gas Co.**
Project: Line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.
Status: Long-range plans.

• **Carolina Pipeline Co.**
Project: Distribution lines to serve 14 cities in Central South Carolina. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.
Status: Has received South Carolina Public Service Commission permit.

Cities Service Gas Co.
Project: 3 miles of 12-in., 8 miles of 10-in., 5 miles of 8-in., 7 miles of 6-in., and 8 miles of 4-in. in Eureka fields, Grant and Alfalfa counties, Oklahoma.
Status: Under way.
Contractor: **Vaughn & Taylor.**
Completion: January 15, 1957.

• **Cities Service Pipe Line Co.**
Project: 27 miles of 6-in. from Lake Charles, La., to Orange, Tex.
Status: Planned.
Completion: April 30, 1957.

• **Coastal Transmission Corp.**
Project: 575 miles of 12, 20, 22, 24-in. main line and 368 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Awaiting FPC approval.
Completion: January 1, 1958.

• **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.

• **Colorado Interstate Gas Co.**
Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.
Status: Pending FPC approval.

Commonwealth Natural Gas Corp.
Project: 40 miles of 18-in. looping from Gum Springs to Chester, Va.
Status: Under way.
Contractor: **Pipeline Maintenance & Construction Co.**
Completion: January 15, 1957.

• **El Paso Natural Gas Co.**
Project: 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix.
Status: Under way.
Contractor: Doing own construction.
Completion: February 1, 1957.
Project: 146 miles of 34-in. between San Juan basin and Topock.
Contractor: **Western Pipeline, Inc.**
Completion: February 1, 1957.
Project: 29 miles of 30-in. from Lindrith Station to Chaco Plant, New Mexico.
Status: Planned.
Project: 29 miles of 18-in. from Panoma Plant to Dumas Plant, Texas.
Status: Planned.
Project: 84 miles of 34-in. looping on San Juan main line and 21 miles of 30-in. looping on Permian-San Juan line.
Status: Planned.
Completion: June 30, 1957.
Project: 23 miles of 20-in. from South Andrews Station to Shell's TXL Plant, Texas.
Status: Planned.
Project: 9 miles of 16-in. from Shell's TXL Plant to Goldsmith Plant, Texas.
Status: Planned.
Project: 8 miles of 26-in. Southern System second loop west of Gila Station, Arizona.
Status: Planned.

Fish-Service & Management Corp. (Agent for Cascade Gas Co.)
Project: City distribution system—205 miles of 1 to 8-in. in Washington and Oregon.
Status: Under way.
Contractor: **Ted Price Construction Co.,**

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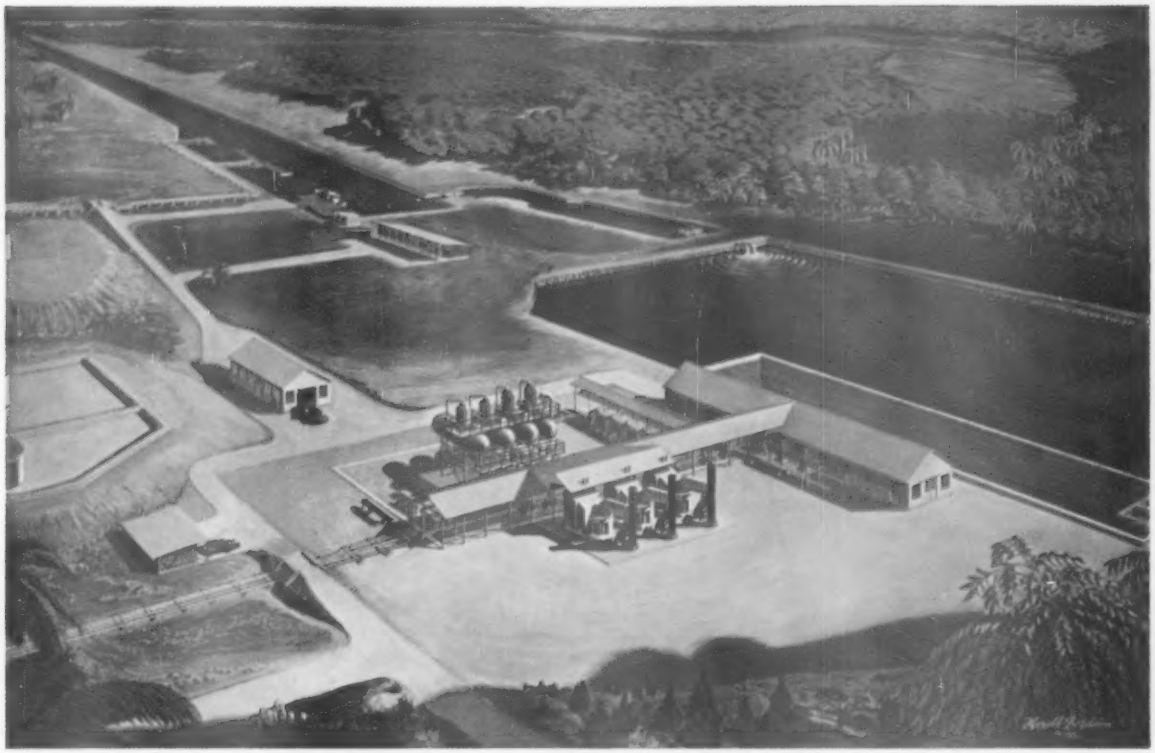

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Pipeline Patrol

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Completion: March 1957.

- **Houston Texas Gas & Oil Corp.**

Project: 960 miles of 26-in. between Baton Rouge, La., and Miami, Fla., plus 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

Status: Pending FPC approval.

- **Iron Ranges Natural Gas Co.,** St. Paul.

Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.

Status: Application pending with FPC.

- **Kansas-Nebraska Natural Gas Co.**

Project: 61 miles of various size gathering line in Camerick field, Texas County, Oklahoma.

Status: Approved.

Project: 10 miles of 10-in. between Grand Island and Fullerton, Nebr.

Status: Approved.

Completion: May 1, 1957.

Project: 12 miles of 12-in. between Scott City and Colby, Kans.

Status: Approved.

Completion: May 1, 1957.

Michigan Consolidated Gas Co.

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank Morris, spread superintendent, office at Hart, Mich.

- **Michigan Wisconsin Pipe Line Co.**

Project: 24 miles of 24-in. and 16 miles of 4-in. looping in Michigan, Indiana, Illinois, Wisconsin, Iowa, and Missouri.

Status: Approved.

Completion: 1957.

- **Midwestern Gas Transmission Co.**

Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.

Status: Application pending with FPC.

- **Mountain Fuel Supply Co.,** Salt Lake City.

Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.

Status: Has temporary FPC permit.

- **Natural Gas Pipeline Co. of America**

Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex.

Status: Has FPC approval.

Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.

Status: Application pending with FPC.

- **North Carolina Natural Gas Corp.** (Subsidary of Colonial Natural Gas Corp.)

Project: 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.

Status: Has permit from North Carolina Utilities Commission.

- **Northern Natural Gas Co.**

Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.

Status: Under way.

Contractor: **Troth Construction Co.**

Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

Status: Planned.

- **Offshore Gathering Corp.,** Houston.

Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)

Status: Application pending with FPC.

- **Ohio Fuel Gas Co.**

Project: 19 miles of 5, 12, 16-in. to replace or loop present facilities serving Dayton and Toledo areas, and extend service to McCutchenville.

Status: Pending FPC approval.

- **Pacific Gas & Electric Co.**

Project: 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.

Status: Under way.

Contractor: **Engineers Limited Pipeline Co.**

Project: 135 miles of 34-in. looping of the Topock-Milpitas line.

Status: Under way.

Contractor: A joint-venture firm, **Midwestern-Johnson-Dixon,** has 85 miles to complete this year.

Completion: Major part to be laid in 1956; 62 miles in 1957.

Project: 200 miles of 12-in. from Sacramento Valley gas fields to Humboldt County, California.

Status: Has filed for approval of Cali-

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Pipeline Patrol

fornia's Public Utilities Commission. To start early 1957.

Completion: December 1, 1957.

- **Pacific Northwest Pipeline Corp.**

Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.

Status: Has FPC permit.

- **Peoples Natural Gas Co.**

Project: 8 miles of 8-in. between Claysburg and Hollidaysburg, Pa.

Status: Planned.

Completion: August 1957.

- **Permian Basin Pipeline Co.**

Project: 83 miles of 16-in. from its Spraberry station in Midland County, Texas, to tie in with Pioneer Gathering System, Inc., at a point in northwestern Schleicher County, Texas.

Status: Filed for FPC approval.

- **Piedmont Gas Co.,** Hickory, N. C. (Parent is Carolina Natural Gas Corp.)

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Status: Application pending with FPC.

- **Pioneer Gathering System, Inc.**

Project: 27 miles of 16-in. and 27 miles of 12-in. in Schleicher and Sutton counties, Texas.

Status: Filed for FPC approval. Estimate to start work March 1, 1957.

Completion: July or August 1957.

Southern California Gas Co. and Southern Counties Gas Co. of California.

Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.

Status: Right-of-way and ditch under way; pipe laying begins in January, 1957.

Contractor: **R. H. Fulton & Co.**

Completion: June 30, 1957.

- **Southern Natural Gas Co.**

Project: 10 miles of 8-in. gathering lines between Napoleonville and Fort Jackson, La.

Status: Pending FPC approval.

Completion: August 1, 1957.

Spokane Natural Gas Co.

Project: 400 miles of 1 through 24-in. distribution system at Spokane.

Status: Under way.

Contractor: **Hallmac Construction Co.**; V. L. Williams, spread superintendent, office at Spokane.

Completion: 1957.

- **Tennessee Gas Transmission Co.**

Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.

Status: Pending FPC approval.

Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.

Status: Pending FPC approval.

Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.

Status: Pending FPC approval.

Project: 76 miles of 24-in. between Coudersport, Pa., and Hamburg, N. Y.

Status: Pending FPC approval.

- **Texas Eastern Transmission Co.**

Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.

Status: Under way.

Contractor: **Houston Contracting Co.** has 121 miles of 30-in. between Angleton and Vidor, Tex., to start March 1, 1957. **H. C. Price Co.** has 70 miles of 30-in. **H. B. Zachry Co.** has 201 miles of 30-in. starting near McAllen and running northeast to near Angleton, Tex. **Grayco Constructors, Inc.** has 45 miles of 24-in. laterals from Blessing to Provident City. **Western Pipe Line, Inc.**, Austin, has 30-in. crossings at Nueces, Lavaca, and Carancahua bays. **Missouri Valley Dredging Co.**, Omaha, has crossings at Hinds and Guadalupe bays.

Completion: Fall 1957.

- **Trans Carolina Pipe Line Corp.**, Commercial Building, Raleigh, N. C.

Project: 300-mile system across North and South Carolina, plus 500 miles of laterals.

Status: FPC approval pending.

- **Transcontinental Gas Pipe Line Corp.**

Project: 25 miles of 36-in. loops from Louisiana to South Carolina, 31 miles of 36-in. and 43 miles of 30-in. line.

Satus: Pending FPC approval.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.

Project: 140 miles of 20-in. from Safaniya field in the Persian Gulf to Ras Tanura, Saudi Arabia, plus an 8-in. gathering system in the gulf.

Status: Under way.

Contractor: **International Bechtel Brothers, Inc.**

Completion: April 1, 1957.

Bolivian Gulf Oil Corp.

Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.

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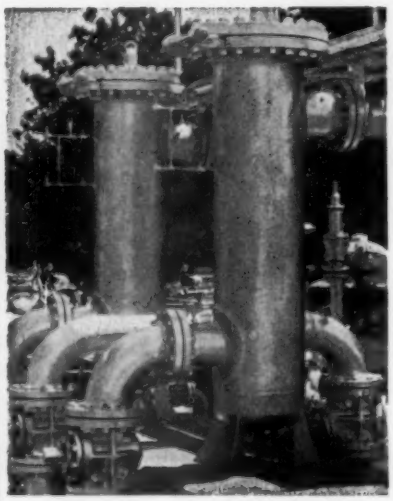

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Pipeline Patrol

Contractor: **Williams Brothers Co.**
Completion: December 1957.

- **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumhell field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

- **Interprovincial Pipe Line Co.**

Project: 151 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.
Status: To start May 1957.
Completion: September 1957.
Project: 33 miles of 24-in. from Kendal to Peebles, Sask.
Status: Planned.
Completion: September 1957.
Project: 79 miles of 26-in. from Clearbrook, Minn., to Superior, Wis.
Status: Planned.
Completion: September 1957.

- **Iraq Petroleum Co.**

Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq and Turkey to the Turkish port of Iskenderun on the Mediterranean sea.
Status: Proposed. Survey completed.

- **Mene Grande Oil Co.**

Project: 11 miles of 6-in. from Elias to Fria, and 10 miles of 10-in. from Limon to Leona-Dacion lateral, Venezuela.
Completion: First quarter 1957.

- **North-West Oil Pipelines Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)

Project: 210-mile line from the refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
Status: Planned.
Completion: 1959.

Pembina Pipe Line, Ltd.
Project: 100 miles of 3 to 10-in. gathering system in Pembina field.
Contractor: **Sparling Davis Co., Ltd.**
Project: 200 miles of 3 to 12-in. gathering line in Pembina oil field.
Contractor: **Mannix, Ltd.**; F. Whitlow, spread superintendent, office at Pembina oil field.

Rangeland Pipe Line Co.
Project: 48 miles of 12-in. between Sundre and the Sylvan Lake in south-central Alberta.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.**
Completion: August 1957.

- **Royal Dutch-Shell**

Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

- **Sinclair Oil Corp. and Socony Mobil Oil Co.**

Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.
Status: Under way.
Contractor: **Williams Brothers Sudamericano, Ltd.**

Union of Soviet Socialist Republic
Project: 2,300-mile Trans-Siberian crude and products line from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.
Status: Under way.

- **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 34 miles of 4, 6, 8-in. gathering lines.
Status: Planned. Has requested permit from Board of Transport Commissioners.

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Pipeline Patrol

Yacimientos Petroliferos Fiscales (Argentina)
Project: 700 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Under way.
Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Foreign Products Pipelines

Hydrocarbons Pipeline Co. (Subsidiary of Canadian Hydrocarbons)
Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start early 1957.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

• **Iraq Petroleum Co., Ltd.**
Project: 75 miles of 24-in. from Homs, Syria, to Tripoli, Lebanon.

Israeli Government
Project: A 6-in. line from the Haifa refinery to Tel Aviv.
Completion: Late 1957.

National Iranian Oil Co.
Project: 573 miles of 10-in. from Ahwaz to Teheran, Iran.
Contractor: **Enterpose of Paris,** has northern 236 miles. Southern section completed.

• **North Atlantic Treaty Organization (NATO)**
Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractors: **Associated Pipeline Contractors, Inc.,** has 450 miles from Iskenderun, Turkey, to Batman. **TECHINT** (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956 on 300 miles of 12-in. between Marseille and Langres, France. Taking bids on 275 miles in northwestern France: 54 miles of 2-in. from Langres to Mirecourt, 63 miles of 2-in. from Mirecourt to Phalsbourg, 47 miles of 8-in. from Mirecourt to Metz, 30 miles of 8-in. from Phalsbourg to Deux Ponts, 35 miles of 8-in. from Phalsbourg to Strasbourg.

United States Defense Department
Project: Sponsoring 485 miles of 8, 10, 12-in. from Cadiz to Zaragoza, Spain.
Contractors: Prime contractor — **Brown-Raymond-Walsh; Merritt Chapman & Scott, Benson & Montin** of Oklahoma City, **Agroman Construcion Co.** of Spain.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**
Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Contractor: **Dutton-Williams Brothers, Ltd.,** has preliminary studies, design and management-engineering. **Mannix, Ltd.,** has crossing of Red Deer River near Cavendish, Alta.
Status: To start in 1957.

Cia. Shell de Venezuela.
Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.
Status: Under way.
Completion: 1957.

• **Empresa Nacional Del Petroleo.**
Project: 80 miles of 10-in. from Concon to Santiago, Chile.
Status: Planned.

Imperial Oil, Ltd.
Project: 37 miles of 12-in. from Waterdown to North Toronto, Ont.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.,** Odis Hare, spread superintendent, office at Cooksville, Ont.

Inland Natural Gas Co., Ltd.
Project: 350 miles of 12 to 4-in. system between Savona and Nelson, British Columbia, and 400 miles of distribution piping in 31 towns.
Status: Clearing and grading under way.
Contractor: **Dutton-Williams Brothers, Ltd.;** Pat Campbell, project manager, office at Penticton.
Completion: October 1957.

Petroleos Mexicanos
Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.
Status: Planned.

Saskatchewan Power Corp.
Project: 300 miles of 1 to 20-in. distribution system at Regina City.
Status: Will start in 1957.
Contractor: **Fulton Banister, Ltd.**
Completion: October 15, 1957.

Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.
Project: 207 miles of 26-in. from Anaco fields to Caracas, plus a distribution system in Caracas.
Status: To start spring or summer 1957.
Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.
Completion: Spring 1959.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal.)
Status: Under way.
Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leaonard, spread supt., office at Cabri.; **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work, general supt., office at Moose Jaw, and 54 miles from Partoze La Prairie to Winnipeg); **Mannix, Ltd.** (90 miles from Moose Jaw to Welseley, spread superintendent, T. Anderson, office at Montmartre, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (97 miles from Deveren to Moosomin, under way, to complete August 1957). **Price-Poole** of **Canada, Ltd.** has 100 miles from Miniota to near McGregor to start in 1957.
Completion: Late summer 1957.

Westcoast Transmission Co., Ltd.
Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.
Status: Under way. About two-thirds completed.
Contractors: **Dutton-Williams Brothers, Ltd.,** has 120 miles from Taylor, B. C., to Azouzetta Lake, completed; **Mannix, Ltd.,** has 110 miles between Huntingdon and Merritt, Fred Byers, spread superintendent, office at Chilliwack; **Canadian Bechtel, Ltd.,** has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.,** has 210 miles; **River Construction Corp., Ltd.,** has under way 150 miles of gathering lines in northern Alberta and British Columbia.
Completion: Dutton-Williams section completed. R. A. Conyes section and Canadian Bechtel section to be completed September 1957. **Marine Pipeline & Dredging, Ltd.** has Fraser and Peace River crossings to complete April and May 1957.

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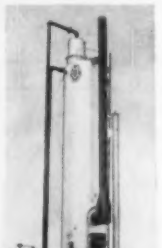

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Drilling Contractors

Gibson Drilling Co., Kilgore, Tex., is drilling for L. O. McMillan at a wildcat location, 1 Rutledge, in the E. Parsons Survey, 3½ miles north of Elmo, in Kaufman County, East Texas.

Thomas Drilling Co. has scheduled a 13,000-ft. test for Cities Service Production in eastern Lea County, New Mexico. Location at 1 Stiles, in 5-17-38, is about 4 miles west of the Knowles area.

Wilson Drilling Co., Jackson, Miss., is drilling for John S. Callon at a wildcat location in the Oakwood area, southern Jefferson County, Mississippi. It is a 6,000-ft. Wilcox test at 1 Walser, in 27-8n-1w.

Wise Drilling Co., San Antonio, has a new wildcat operation in southeastern Frio County, southwestern Texas. It is a 6,000-ft. Navarro-Olmos test for M. L. Wise, of the contracting company, and Reagan Tucker, also of San Antonio. Location is for 1 McKinney, in the J. W. Thompson Survey.

Larco Drilling Co., Jackson, Miss., has taken on a well-deepening job in Harrison County, on Mississippi's coast. It is for Texas Crude Oil Co. at 1 Elmendorf, in 13-6s-11w, about 7 miles north of Gulfport. The hole, drilled by City Products Co. to 9,500 ft. and abandoned in the top of the Lower Cretaceous, will be taken to the lower part of that section.

Woolf & Magee, Tyler, Tex., have a new 7,000-ft. operation in northern Wilkinson County, southwestern Mississippi. It is a Wilcox test for Wilkinson Oil Co. at 1 Vines-Ashley Unit, in 7-4n-1w. Location is about 3 miles west of Ireland field.

Glasscock-Wilson, Inc., Shreveport, has taken on a 12,000-ft. job in southeastern Calcasieu Parish, in southwestern Louisiana. It is for W. E. Walker, of Lake Charles, at a wildcat location in 26-11s-7w, about 3 miles southwest of the South Bell City area, and about the same distance northeast of Chalkley field. It is about 15 miles southeast of Lake Charles.

Petersen Drilling Co., Shreveport, has a rig working for Marlin Exploration Co., also of Shreveport, at a wildcat location 2 miles northeast of Harrisonburg, in northern Catahoula Parish, eastern Louisiana. It is a 5,500-ft. Wilcox test at 1 Louisiana Central, in 32-10n-7e. Petersen also is scheduled for a 6,700-ft. Wilcox test to be drilled for

ON THE FLOOR of Arabian American Oil Co.'s rig operating at Kharsaniyah, on the Persian Gulf Coast of Saudi Arabia. Left to right: Fred Waldron, geologist, Chicago; L. E. Shaffer, driller, Oklahoma City; Earl Cooper, rig mechanic, Los Angeles; Carl Washburn, drilling foreman, San Francisco; and H. M. Berk, driller, Atlanta. The rig is drilling at a 4-mile "stepout" to Aramco's new-field discovery well (The Oil and Gas Journal, December 24, page 56), 80 miles northwest of Dharan, company headquarters.

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If mud gets to your joint threads, it can wash out a string in a hurry. 'Bestolife Lead Seal Tool Joint and Casing Compound gives maximum, tight joint make-up, keeps mud out. Standard of the oil country for over twenty-five years. Unconditionally guaranteed. Packed in 1¼, 5, 20 and 50 lb. containers. Sold by leading supply houses throughout the world.

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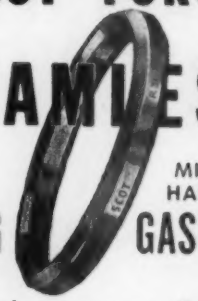

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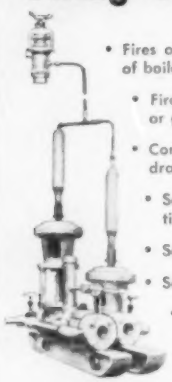

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the same operator at 6-A Madison, in 34-6n-9e, 2 miles southwest of Willets, in eastern Concordia Parish, about 30 miles southeast of the Harrisonburg test.

Atlas Drilling Co., Opelousas, La., has a rig working on an outpost location east of South Bayou Mallet field, in Acadia Parish, southern Louisiana. It is a 10,300-ft. test for LaGloria Oil & Gas Corp. at 1 Blanchard.

Crow Drilling Co., Shreveport, is getting under way on a contract it has with Alvin M. Jackson and M. F. McCain for an 8,600-ft. Frio test 6 miles north of Basile, in Evangeline Parish, southern Louisiana. Location is at 1 Lafleur, in 40-6s-2w.

John Langford, Houston, is contractor on a 4,000-ft. test Rio Grande Valley Gas Co., of Brownsville, Tex., is undertaking at a wildcat location 4 miles southeast of New Lopeno, in Zapata County, in far-southwestern Texas. Location is on the operator's Idelfonso Ramirez Estate lease, in Porcion 18.

Grady Roper has the contracts for two tests Sam J. Recile, of New Orleans, has projected on the east flank of Lockport field, southwest of Lake Charles, in Calcasieu Parish, southwestern Louisiana. Locations are on the operator's Gray lease, in 10-10s-9w.

Carter & Beveridge, Houma, La., have a rig under contract to Ted Weiner for another well in the Orange Grove area, southwest of Houma, in Terrebonne Parish, southeastern Louisiana. The well will be Weiner's 6-D Wylie, in 84-17s-16e. Contract is for 11,000 ft.

Richardson & Stewart Drilling Co., San Antonio, has contracted for a 14,500-ft. test Union Oil Co. of California will drill at an outpost location in the Turtle Bayou area, Terrebonne Parish, southeastern Louisiana. The operation is listed at 2-K Continental, with location in 5-18s-14e.

Sunnyland Contracting Co., Rayne, La., is contractor, with operating interest, on two more southern Mississippi wildcat tests, one in Wilkinson County, and the other in Jefferson County. In the Wilkinson job, a 7,900-ft. Wilcox test, Sunnyland is associated with Billups Brothers. Location, in 36-3n-1w, is about 1½ miles southwest of Soapstone field, in the northern part of the county. The Jefferson County test is a joint venture with E. G. Jeffreys at 1 Brown, in 36-9n-1e, about 2 miles southeast of Fayette field. It has a 5,500-ft. Wilcox objective.

Two Engines Do the Work of Three

Two Le Roi L3460's (600 hp each) provide ample power for 10,500-ft. drilling job.

Have given three years of steady service without need for overhaul or major repairs.

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No maintenance problems to eat up profits. Dependability is built into all Le Roi drilling engines. The L3460 is no exception.

The integral V-12 design of these units consists of a one-piece crankcase and cylinder construction that eliminates misalignment. Large-diameter, short-length, counter-balanced crankshaft with generous bearing surface handles all the L3460's power without vibration. Internally ribbed crankcase provides solid crankshaft support and has an extra main bearing at the flywheel end to absorb side-thrust.

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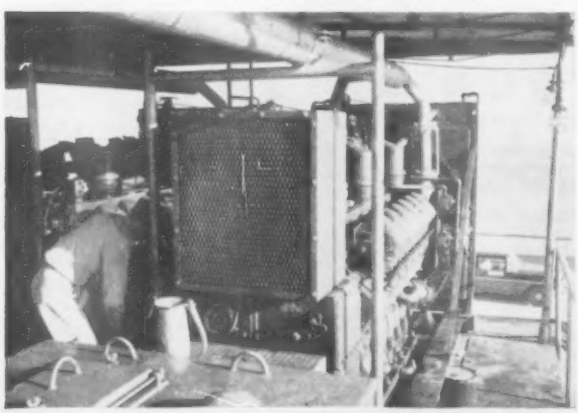
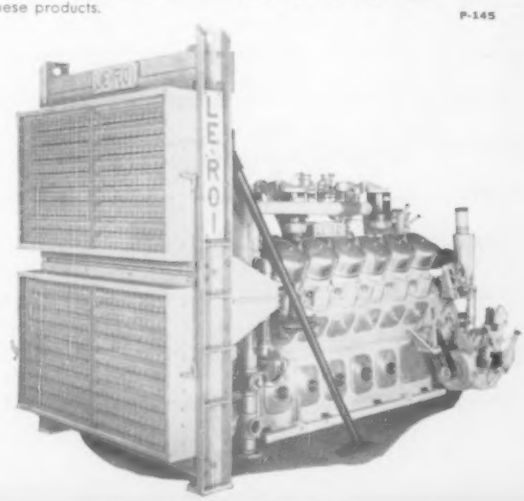
P-145

Closeup of Le Roi L3460 Drilling Engines. They develop 600 maximum horsepower each, yet they are remarkably compact.





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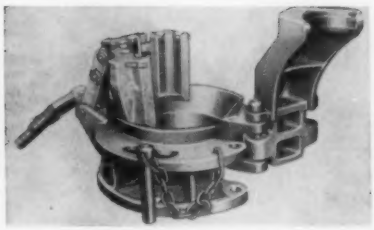

Automatic Tubing Spider Handled by One Man

A new Type H automatic tubing spider in 2, 2½, or 3-in. tubing size has been designed for medium or light duty. Twelve heat-treated solid-slip inserts are placed to fit exactly and take a firm grip on the tubing. Replacement inserts are priced economically. The full set may be replaced, for about the usual resharpening charge of conventional slips. The spider is gripped easily by convenient slots in the top flange and the complete unit may be handled by only one man safely.

Unless otherwise specified, the spider is furnished with a guard gate which protects the slips and linkage against accidental blows from the elevators. The built-in guard also serves to center the tubing in the spider bowl. Where lighter weight is essential, the spider is available at no extra cost with a plain gate.

The slips, of three-point-contact design, give maximum support without crushing the tubing. Slips will support J55 tubing up to 9,000 ft. in 2⅜-in. o.d. 4.7 lb., 8,000 ft. in 2⅞-in. o.d. 6.5 lb., or 6,000 ft. in 3½-in. o.d. 9.3-lb. size. Slip inserts pivot and grip against rotation in either direction, eliminating need for backups. All parts are interchangeable. **Write or call: Guiberson Corp., Box 1106, Dallas, Tex., for more information on the Type H tubing spider.**

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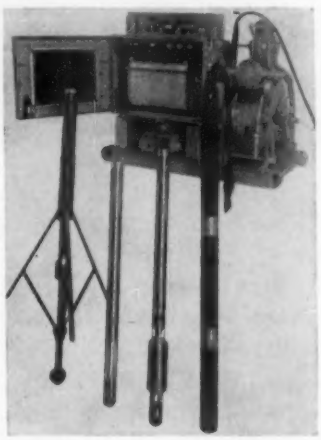

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A dry-hole electrode is used in dry, air-filled holes where it is impossible to log with a conventional subsurface electrode. The gamma-ray probe is used for the logging of cased wells, of uncased wells containing salty mud, and of formations which cannot be identified readily from an electronic log alone. The temperature probe is usefull for: locating the points of entrance of gas and oil in cable-tool holes, water in rotary wells, for following the pro-

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ROTARY HOSE SERVICE CERTIFICATE

THIS IS TO CERTIFY that the undersigned Supply Company has this day sold and delivered to the Customer named above one Goodall Rubber Company Rotary Hose described as follows:

Serial Number *Size* *Length* *Goodall Specification Number*

and this certificate is issued specifically for the purpose of bringing the said hose within the provisions of the above numbered contract to the above named Customer, and this certificate shall be valid and effective when executed by an officer of said Goodall Rubber Company.

The Goodall Rubber Company hereby unconditionally guarantees Goodall Rubber Co. Rotary Hose against failure due to any defect in workmanship and/or material for the period of one year from date of purchase. If at any time during the 12-month period from date of purchase, such Rotary Drilling Hose as identified by the Service Certificate should meet with accident under normal operating conditions, the Goodall Rubber Company agrees to:

A. Repair such hose without charge to the customer, other than transportation charges to and from the plant designated by the Company, provided in the opinion of the Company it can be made suitable for further use as Rotary Drilling Hose.

B. Convert any such Rotary Hose damaged by accident to such an extent that it cannot reasonably be made useable thereafter as Rotary Hose into as many vibrator hoses as possible, free of charge to the customer except for necessary additional couplings and freight to and from the specified plant.

WITNESS our signature at _____ on the _____ day of _____, 195____.

Accepted and Validated:
GOODALL RUBBER COMPANY

By _____
Title

_____
SUPPLY COMPANY

By _____
Title

Only Goodall offers this guarantee

The Goodall Guarantee shown above is one example of the Goodall way of showing their appreciation to the Drilling Industry. Goodall's success is due to the acceptance of their rotary hose by users all over the world. In order to keep their position at the top Goodall will continue to offer the finest product of its kind made—the Goodall Rotary Hose with the Barney Coupling—at competitive prices.

Goodall stays at the top because they have always pioneered a better product. Some examples are: the first high pressure rotary hose—the Barney Coupling—the Goodall repair service—the built-in safety clamp.

GOODALL RUBBER COMPANY

TRENTON, N. J.

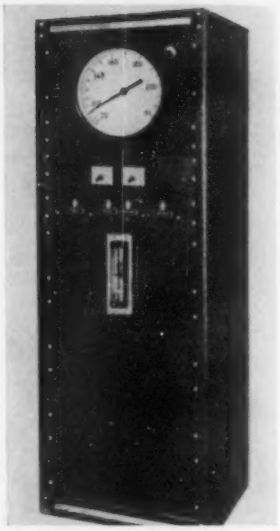
GOODALL RUBBER COMPANY OF TEXAS: Houston, Odessa, San Angelo, Texas.
GOODALL RUBBER COMPANY OF CALIFORNIA: San Francisco, Los Angeles, Seattle, Salt Lake City, Portland.
GOODALL RUBBER COMPANY: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul, Detroit.
EXPORT: Goodall Rubber Company, Trenton, N. J.
STOCKING DISTRIBUTORS: Texas and Louisiana—Houston Oil Field Material Co., Wilson Supply Co., Hunt Tool Company, Heap Equipment Co.; Oklahoma—Iverson Supply Co.; Kansas—Mountain Iron & Supply Co.

duction progress of sulfur in deposits exploited by the Frasch process, and other investigations.

All of the standard tools have a diameter not exceeding 3 in. Special tools also are available for the logging of small holes. These tools can be operated by any member of the drilling crew. **Write or call: Well Instrument Developing Co., Box 282, Bellaire, Tex., for more information on portable well-logging equipment.**

Refractometer Monitors and Controls Process Streams

A new automatic-process refractometer can be used in petroleum and petrochemical fields. Hundreds of applications are possible, as the instrument is able to plot refractive index changes in nonopaque liquid or gas stream. In refineries the instrument may be used for continuous monitoring and control of fractionating towers or blending of streams. It can be supplied to meet Class I Group D requirements for hazardous locations. It is the null type of refractometer and is designed



for continuous operation on any 115-volt single-phase 60-cycle a.c. line. Batteries are not required. **Write or call: Phoenix Precision Instrument Co., 3803-05 N. Fifth Street, Philadelphia 40, Pa.**

KEEP YOUR MUD IN BALANCE

with

"Mud-O-Graf"

- Provides accurate information for uniform mud control.
- Helps prevent blowouts by showing the duration and relative amount of gas in gassy streaks.
- Eliminates guesswork in the use of weighting materials, chemicals, and water.
- Indicates graphically all heavy and light streaks in the circulating system.

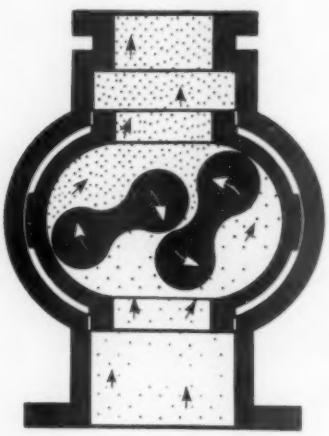
The condition of mud in the hole is recorded automatically during every minute of the drilling operations. Weight variations of less than 1/10-pound per gallon can be detected. Mud-O-Graf has been proved in fourteen years tough field service. It eliminates trial and error methods of adding weighting materials. It detects gas or salt water incursions which could cause blowouts.

WARREN AUTOMATIC TOOL CO.

Manufacturers of Pit-O-Graf and Rig Runner.

Houston CApitol 4-2511 Odessa 6-5861 Lake Charles HEmlock 6-2265 New Iberia 2-7131 Harvey FIllmore 1-3721 Hobbs, N. M. 3-8218 Lafayette 5-5313

Export Representative: International Oil Equipment Co. 30 Rockefeller Plaza, New York City



Vacuum Pumps Require No Oil Sealing in Pump Chamber

A new line of fast, Roots-type vacuum pumps includes six standard sizes. They cover maximum-speed ranges from 92 to 4,900 cu. ft. per minute. Basic mechanism is a pair of figure-eight-shaped rotors which counter-rotate in the pump chamber. These finely machined rotary pistons never touch one another or the pump casing. Consequently, no oil sealing (which would contaminate the vacuum system with backstreaming vapors) in the pump chamber is required.

Featuring quiet, vibration-free operation and low power consumption, these pumps have motors which operate within the vacuum, eliminating need

for shaft seals, which are frequently sources of leakage. Roughing is done directly through the pump without the need of by-pass or valving. **Write or call: Rochester Division, Consolidated Electrodynamics Corp., 1775 Mount Read Boulevard, Rochester 3, N. Y., for more information on Roots-type vacuum pumps.**

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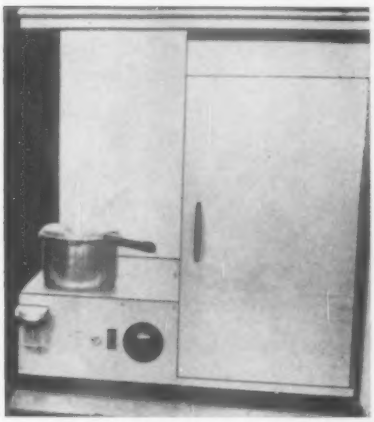


Centrifuge Core Cleaner Speeds Core Testing

This new centrifuge quickly cleans core samples cut from an oil-bearing formation. It is adaptable for cleaning any porous material, such as filters, where 100 per cent of carbon contaminate must be removed.

In recent tests, cores of 18 to 23-per cent porosity were saturated with 40°-gravity A.P.I. oil. Permeability of these sample cores ranged from 11 to 62 md. Within 20 minutes the new centrifuge core cleaner had removed 100 per cent of the oil.

The core samples are placed in a flat-disk container which is then attached to a core fitted to the shaft of the motor. Both the outer rim and the hollow hub of the basket contain perforations for the passage of the solvent and extract. The solvent is delivered to the perforations through a stainless tube inserted into the hollow hub.

When the centrifuge cover is locked into place, the centrifuge is brought slowly to the desired speed. Hot solvent is allowed to flow by gravity from the condenser above the solvent still to the siphon bottle.

Solvent striking the face of the core samples emerges with the dissolved oil (or hydrocarbon contaminates) from the opposite face. This extract is returned to the still through a glass observation cell and the extraction process can be observed. The core basket will hold up to eighteen 1-in. samples, cubical or cylindrical.

The centrifuge is self-balancing to prevent injurious vibration when less than the maximum number of samples are being cleaned. Pilot units of the centrifuge have been used in the research laboratory of a leading petroleum company for the past 5 years. **Write or call: Exline Engineering Co., 107 West Second Street, Tulsa 3, Okla.**

•

Ready-Cured Tank Lining Material in Kit Form

A new tank-lining sheet provides excellent over-all chemical resistance. Ready-cured, it eliminates the necessity of curing in the field. It is stable in storage and therefore requires no refrigeration. Stretch approaches that of natural-rubber lining.

Fairprene T-5594 ready-cured synthetic-rubber lining has been developed for tank lining applicators and companies who do their lining. It is offered as part of a package which consists of primers and adhesives for adhering to metal tanks, an adhesive for strapping seams, and a putty for filleting joints and corners.

Fairprene T-5594 is available only in a two-ply, 50-in. width with ⅛-in. thickness. Applied cost per square foot generally is less than natural rubber and other materials now in use. The lining has been field tested satisfactorily.

With modification the above system can be used to cover wood or concrete surfaces. **Write or call: E. I. du Pont de Nemours & Co., Fabrics Div., Wilmington, Del., for more information on Fairprene T-5594.**

•

Controller Makes Tube Expanding Easier

The air magnetic controller brings a new concept of torque control to tube expanding. Its operation is based on a powerful permanent magnet that gives positive and instantaneous engagement and disengagement between driving mechanism and the driven expander.

OIL AND GAS JOURNAL Showcase .....OF NEW EQUIPMENT

Send this Showcase Coupon to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in boldface type at end of description.

• • •

NAME AND/OR MODEL NUMBER _____

_____

_____

Described in OIL AND GAS JOURNAL - Issue of Jan. 7, 1957

NAME _____ TITLE _____

COMPANY _____

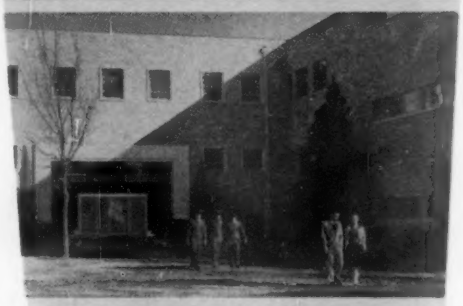
ADDRESS _____

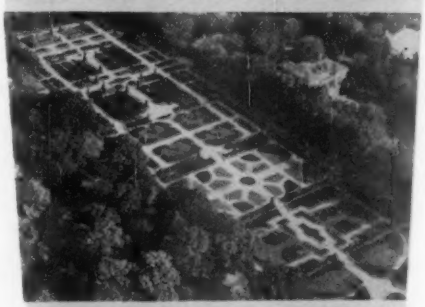
CITY _____ STATE _____

DATE _____

ENGINEERS... DESIGNERS...

. . . Live in TULSA, the young man's city . . .





Live, work and progress in Tulsa, Oklahoma, the city built for those who are young in heart—a city that offers every facility for better living. There are tree-lined streets with parks and playgrounds and excellent schools for your children. Many nationally-known lakes close to Tulsa provide fishing, swimming and water skiing. Tulsa's plentiful supply of crystal clear, pure water comes from mountain lakes in the Ozarks. Winters are mild, with few days below freezing temperatures. There are opportunities for additional education through Tulsa University night classes.

The REFINERY ENGINEERING Company seeks experienced Engineers and Designers in these classifications: **Piping, Instruments and Electrical Engineers; Piping, Structural Steel and Reinforced Concrete Designers.** Applicants must have a minimum of 2 years experience in process plant design. Now working a minimum of 45 hours per week. Ideal working conditions. Company paid insurance. Company sponsored retirement plan. You can drive to work in from 5 to 15 minutes. Free paved parking. Allowance for moving your furniture.

Our firm is a young but well-established and aggressive company with an enviable past and a bright and promising future in the refining, chemical, rare ore and nuclear fields.

Your reply will be kept confidential.

Write to Glenn O. Hopkins, Personnel Manager

TRECO

A DIVISION of VITRO CORPORATION of AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

Please fill out coupon and mail for immediate action.

The REFINERY ENGINEERING COMPANY
P. O. Box 1558 Tulsa, Oklahoma

Name ..... Address .....
City ..... State ..... Age .....
Education .....
Work Experience .....
Check One:
☐ PIPING ☐ STRUCTURAL STEEL ☐ REINFORCED CONCRETE
☐ INSTRUMENTATION ☐ ELECTRICAL

The controller is air-driven and therefore ideal for rolling tubes in hazardous locations. It is a single compact unit (weight 10 lb., length 10½ in.) and is well balanced for ease in handling.

The controller features a sensitive, easily adjusted calibrating dial that permits exact settings for torque control. There are no springs; therefore results are consistent. It has a positive-drive action that stops instantaneously when preset torque is reached. Then, when the expander is disengaged, the motor runs free, which cuts the number of required stops and starts in half. The controller has an on-off locking switch and separate reversing trigger which permits an uninterrupted sequence of operation. It has a quick-release chuck that locks the expander securely, yet allows snap-motion insertion or removal.

The controller comes in a fitted metal case that holds both the control unit and expanders. It operates on 28 to 30 cu. ft. per minute of air at 90 psig. A single ⅜-in. air hose is the only connection required. **Write or call: Elliott Co., Jeannette, Pa., for more information on the air magnetic control tube expanders.**

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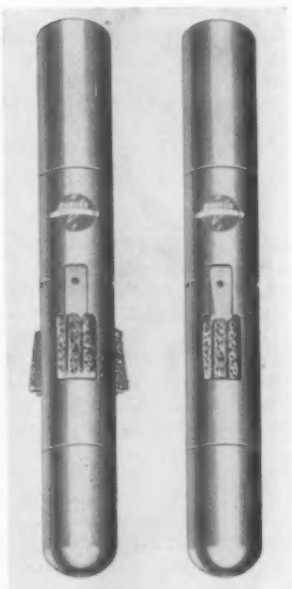


Section Mill Cuts Sections Up to 4 Ft. Per Hour

A new section mill uses a process which suspends tungsten-carbide particles in a tough, elastic matrix. As particles are worn away or torn from the matrix, new cutting edges are exposed. This puts hundreds of cutting edges always in contact with the surface to be cut. Windows can be milled at fast rates even in the N-80 and P-110 grades of casing.

There is ample material on the cutter arms to cut a complete section with one set of arms, saving many round trips. Cutter arms can be replaced easily when lock screws and cutter-arm retainer pins are removed. The section mill is operated by pressure which moves a piston. The piston expands the cutting arms against the casing. **Write or call: Servco Corp., 2450 Cerritos Avenue, Long Beach 6, Calif., for more information on tungsten carbide section mill.**

●

New Tank Liner Allows For Thermal Compensation

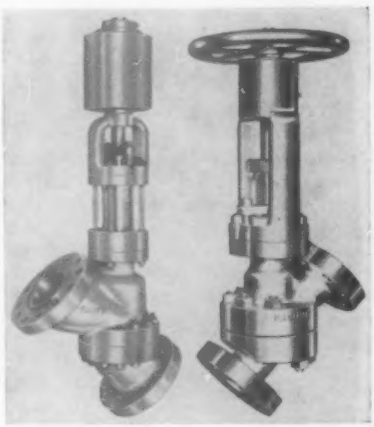
Constructed of Boltaron 6200 unplasticized polyvinyl chloride (Type I), this expansion sheet combines the high corrosion-resistance of PVC with industry's increasing demand for larger tanks and greater allowable temperature differentials. The expansion sheet, a rigid tank liner, was designed to absorb the expansion and contraction by movement of corrugations built into the individual sheets. These corrugations fully compensate the entire sheet in all directions.

The individual sheet (30 by 60 by ⅛ in.) allows tanks of any size to be lined since expansion and contraction is confined to the individual sheet. The problems of buckling, warping, and other distortion are solved. The Boltaron expansion sheet can be used with tanks made of wood, concrete, new or even badly corroded metal, and most other materials. It can be used in any size tank; square or rectangular. **Write or call: H. N. Hartwell & Son, Inc., Industrial Plastics Div., Park Square Building, Boston 16, Mass., for Bulletin No. 4-EL.**

●

Y Globe Valves Cause Less Pressure Drop

These Y globe valves cause 50 per cent less pressure drop than conventional globe valves. They are suitable for L.P.G. and other hard-to-handle gas or liquids. They can be furnished with manual control or cylinder operators using electric or air motors. The valves come in 150, 300, 600, 1,500, and 3,000-lb. series with flanged, screwed, or socket-welded ends in sizes from ½ to 8 in. When furnished with air cylinders, most sizes can be spring loaded to close automatically or open the valve if power fails.



The Y valve requires less head room than conventional valves. It has a Teflon or Kel-F positive soft seal. The seat ring and disk assembly is replaceable. **Write or call: Pacific Valves, Inc., 3201 Walnut Avenue, Long Beach 7, Calif., for more information on Y globe valves.**

●

Desander Weighs Only 115 Lb.

This desander removes sand from drilling mud after the mud has passed over the shaker and is being held for recirculation through the drilling string. It weighs 115 lb. and can easily be carried to the rig. An adjustable orifice at the lower end of the desander cuts the amount of mud lost as the sand is ejected. The desander saves repair bills and down time by reducing the amount of abrasive sand in the mud. Any material coarser than 200 mesh is regarded as sand and good practice calls for less than 5 per cent sand in the mud.

The mud enters the desander in a circular action around its walls. The centrifugal force causes only the very heaviest particles to concentrate at the lower end where they are expelled through an orifice. **Write or call: S. R. Bowen Co., P. O. Box 427, Santa Fe Springs, Calif.**

OIL AND GAS JOURNAL

Showcase

- BULLETINS
- CATALOGS
- BROCHURES

Reliance Totally Protected Motors. Total protection, a new concept in protected enclosures for industrial a.c. motors, is graphically described in the new four-page, two-color Bulletin B-2501. Cutaway views of a new totally protected motor and its components clearly show how it is designed for applications which formerly required dripproof or splashproof motors, yet is guaranteed to operate within a maximum temperature rise of only 40° C. **Write or call: Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio, for Bulletin B-2501.**

●

Rolls-Royce Hydro-Dynamic Torque Converter is described and illustrated in the 2-color, 20-page T.S.D. Publication 710. Two-color engineering drawings present the details and working principles of different converters. A graph furnishes performance figures of a typical engine-cum-converter unit. Other graphs give information on such equipment as a hoist, shovel, and slush pump furnished with torque converters. The booklet discusses converter cooling and fluid systems, and gives a table showing the range of converters of different sizes. **Write or call: Rolls-Royce, Ltd., Motor Car Div., Crewe, England, for T.S.D. Publication 710 on torque converters.**

●

Type W Otis Removable Locking Mandrel Assembly is described as a tool used to lock and pack off Otis removable subsurface flow controls. The three-color fact sheet illustrates and explains the design and applications of the new tool. The Type W locking assembly is used to lock and pack off Otis removable bottom-hole regulators, Otis removable tubing safety valves (storm chokes), and Otis removable bottom-hole chokes. In addition, the Type W can be equipped with either a flow bean or plug bean and used as a bottom-hole choke or as a tubing plug. The locking tool has a heavy-duty packing element and sets on slips. It can be landed at any interval in the tubing string, and does not require a landing nipple made up between joints. **Write or call: Otis Pressure Control, Inc., Box 7206, Dallas, Tex., for Type W Removable Locking Mandrel Assembly fact sheet.**

●

Steam-Jet Vacuum Pumps. Bulletin 5H3 describes three, four, and five-stage steam-jet vacuum pumps and vacuum boosters. The eight-page, three-color booklet covers both condensing and noncondensing types. It has to do with applications, features of the apparatus, materials of construction, and operation. Sizes and dimensions are given in quick-reference tabular form along with performance characteristics for three-stage units. Engineering drawings and photographs are included. **Write or call: Schutte & Koerting Co., Dept. J-2, Cornwells Heights, Bucks County, Pennsylvania, for Bulletin 5H3.**

●

The Flow Line. Vol. 15, No. 5 of this company magazine commemorates the fortieth anniversary of the lubricated plug valve. This colorful, 20-page issue explains how Sven Nordstrom, a young Swedish engineer, invented the lubricated plug valve after a battle with a frozen plug cock. Also described are some of the experiences of the old-time Nordstrom valve salesmen as they attempted to introduce the new invention. **Write or call: Rockwell News Bureau, 400 N. Lexington Avenue, Pittsburgh 8, Pa., for Vol. 15, No. 5 of The Flow Line.**

●

Internal Gear Rotary Pumps. This new three-color folder gives thumbnail descriptions of five new series of internal-gear rotary pumps. Described are Series A, B, C, D, and E. Series A pumps are suitable for light-to-medium-viscosity fluids; Series B pumps are described as hazardous-liquid pumps; rugged-duty packed pumps and rugged-duty sealed pumps are incorporated in the Series C and D pump lines. Series E units are designed with steam jackets. The folder has a return-card which can be used to request the company's main-line catalog plus a short review of Wayne activities. **Write or call: Wayne Pump Co., 207 Tecumseh Street, Fort Wayne 4, Ind., for the Internal Gear Rotary Pump folder.**

●

Attempted Murder is the title of a new 12-page cartoon booklet. It explains the importance of safety head protection and the care and feeding of hard hats. It is available to all safety engi-

DRILLING BARGES • DREDGES • BARGES • QUARTER BOATS • TUGS • WORK BOATS • COMMUNICATION CRAFT • DRILLING STRUCTURES • PERSONNEL BOATS • SEISMOGRAPH BOATS • BULK-TYPE CARGO BARGES • SWAMP SKIPPERS • TANK BARGES • ALSO MARINE REPAIRS OF ALL TYPES

neers for distribution to men who wear hard hats. A recent survey demonstrated that almost 45 per cent of the men now wearing head protection are wearing it incorrectly for maximum protection. Federal specifications recommend all hard hats be worn with a clearance of not less than 1½ in. between the crown of the hat and the top of the head. This is called crown clearance. The greater the crown clearance, the greater the potential-energy absorption of the hard hat and the greater protection. **Write or call: Public Relations Dept., E. D. Bullard Co., 275 Eighth Street, San Francisco 3, Calif., for Attempted Murder booklet.**

●

Low-Temperature Separation is discussed in Catalog 33-01 and the MDH Cold-Frac unit is presented. The unit operates on extremely-high-pressure wells, wells producing wax and/or salt water, and wells with a pressure life of 3 to 5 years. The new unit includes four important design improvements: (1) an improved liquid knockout that gives greater scrubbing efficiency and eliminates wax and salt-water problems; (2) a new heat exchanger which achieves maximum cooling with minimum pressure drop through counterflow with cold sales gas; (3) an improved separator design that effects maximum separation of liquids, hydrates, and gas; and (4) skid mounting of all units in a compact assembly that permits shipment of the completely assembled unit. Field hookup requires only four connections. **Write or call: Black, Sivalls & Bryson, Inc., Product Information Dept., 7500 East Twelfth Street, Kansas City 26, Mo., for Catalog 33-01.**

●

Engine Case Histories. These two-page case histories use pictures and drawings to illustrate applications of modern V-8 and V-12 engines of 540 to 4,000-cu. in. displacement. Applications described in the case histories include: air conditioning, gas boosting, generator sets, oil-well pumping, and oil-well drilling. **Write or call: Sales Promotion Dept., Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1, Wis., for engine case histories.**

●

Cealment is a specialized oil-well cementing service using latex cement. A four-page, two-color folder describes how it is used and explains how it overcomes many of the disadvantages of common portland-cement slurry. It summarizes such features as bonding, resiliency, fluid loss, permanency, and resistance to contamination. **Write or call: Dowell Incorporated, Box 536, Tulsa, Okla., for the Cealment folder.**

●

Axelson Hydrax 4-Foot Jr. is a bulletin that describes the newly developed economical hydraulic-pumping unit with a 4-ft. stroke. The Hydrax Jr. is the smallest hydraulic surface-pumping unit in use. It is recommended for stripper and low-production wells pumping 50 bbl. per day or less. **Write or call: Axelson Manufacturing Co., 6160 South Boyle Avenue, Los Angeles 58, Calif., for the Hydrax 4-Foot, Jr. bulletin.**

MAP
FILE
#MT4
Easiest way to file and find confidential maps, tracings, blueprints. Quality metal cabinet file with locking doors. 112 tilting tubes handle 60" prints. Tubes indexed for quick location. Ideal for field and home offices. Shipped from stock.
Patent No. 1610368. Other Patents Pending.
SCOTT-RICE CO., 610 S. Main, Tulsa 3, Okla.

The Best Fishing Lure

The
BOWEN KINGSTON FISHING MAGNET

Bowen Kingston Fishing Magnets are used to retrieve all types of small objects such as bit cones, slips, milling cuttings, tong pins, hammers, etc. These odd shaped, undrillable objects gather at the bottom of the hole as a result of tool failures and milling jobs or are accidentally dropped down the hole. Such objects cannot be engaged in any conventional manner and in many instances can be engaged and retrieved only with magnetic attraction.

Bowen Kingston Fishing Magnets are an indispensable accessory for all diamond coring operations. Small junk particles such as teeth chipped from bits, broken bearings, etc. can seriously damage a diamond core bit or curtail its performance. In a single run Bowen Kingston Fishing Magnets can completely cleanse the hole of all such particles, safeguard the bit from damage, and insure good performance.

CAN BE RUN ON WIRE LINE OR PIPE

Wire line operations have the advantages of speed and economy. Pipe operations have the great advantage of circulation, which can be used to eliminate settlings above the fish and to loosen the fish.

LONG LIFE

With proper care, the life of the Magnets can be prolonged indefinitely. Keepers are furnished with each Bowen Kingston Fishing Magnet to prevent magnetic dissipation while the tool is not in use.

Bowen Kingston Fishing Magnet Patented

Keeper for Bowen Kingston Magnet

Write for descriptive literature

SR BOWEN CO

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EXPORT OFFICE:
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EXPORT REPRESENTATIVE: VAL A. WITTEK JR.

OIL MEN CALL US 'BANKERS'. . . but BANKERS CALL US 'OIL MEN' ! ! !

You can talk the strange language of Oil with us because we "made up" some of the words! Fifteen of our directors are directly affiliated with the oil industry. We have one of the largest Oil Credit files in the nation; OIL LOAN service that includes oil-wise Trust Dept. counsel. See R. ELMO THOMPSON, R. OTIS McCLINTOCK, RUSSELL F. HUNT, WM. W. MICHAELS, BILL KENDALL or R. H. GWINNER. Remember, in Tulsa . . . in the Middle West . . . it's BOTH pleasant and profitable to . . .

Think 1st *of Tulsa*

FIRST NATIONAL BANK & TRUST CO.

SINCE 1895

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

EQUIPMENT MEN . . . in the News

Rockwell Announces Two Key Sales Promotions

Robert B. Kitzmiller has been named Los Angeles district sales manager, and A. J. Komich has become gas products

KITZMILLER

A. J. KOMICH

manager of Rockwell Manufacturing Co.'s meter and valve division, it has been announced by Lloyd A. Dixon, Jr., vice president.

Kitzmiller joined the company in 1934 as production clerk. He was made a sales engineer in the Pacific Northwest in 1945 and became San Francisco branch sales office manager in 1951, district manager the following year, and gas products manager in 1955.

Komich, who joined Rockwell in 1946 as a sales engineer in the Boston district office, was named gasoline and oil products supervisor for that office in 1951. He moved to Pittsburgh as assistant product manager early this year.

Oilwell Names Butirich as New Orleans Representative

The appointment of Nickola S. Butirich as city representative at New Orleans, La., for U. S. Steel Corp.'s Oil Well Supply Division has been announced by M. F. Jones, Gulf Coast area manager of the division.

Butirich was employed by Oilwell in 1955 and in July 1956 was named field representative at Harvey, La., holding this position prior to his present appointment.

Dowell Makes Appointments

Owen Housley, formerly area manager for Dowell Incorporated at Oklahoma City, has been transferred to Dowell's Salem, Ill., district and promoted to sales manager for the district, according to D. E. Ramsey, manager of operations, Tulsa, and L. J. Kutlich, district manager.

E. A. Ernst, formerly district area manager at Oklahoma City, has been promoted to district engineer and transferred to the district office at New Orleans. The announcement came from Ramsey and C. L. Power, Jr., district manager at New Orleans.

Eldon L. Ervin, formerly station manager at Hominy, Okla., has been transferred to Worland, Wyo., according to Ramsey and E. H. Nielsen, district manager at Denver.

J. G. (Gibb) Boren, formerly service manager at Seminole, Okla., is now station manager at Casper, Wyo.

Housley, who started with Dowell in Tulsa, served at Pauls Valley, Seminole, and Hominy, Okla., before going to Oklahoma City in 1953. Ernst served at Wichita Falls, Tex.; Ulysses, Kans.; Graham and Abilene, Tex., before going to Oklahoma City in 1953. Ernst succeeds Warren Sallee who becomes district sales manager in New Orleans. Ervin started with Dowell at McCamey, Tex., in 1951 as a service engineer. He has been in Hominy since 1953.

Schramm Appoints Stewart Field, Research Engineer

D. E. STEWART

The appointment of Donald E. Stewart as field and research engineer with headquarters in Tulsa has been announced by Philip L. McLaughlin, director of the petroleum division of Schramm, Inc. In the past 10 years Stewart has done research work and conducted field tests in air drilling for Stanolind Oil & Gas Co. in the research center at Tulsa.

Hardy-Griffin Names Sales And Service Engineer

W. L. (Bill) Phillips, veteran oil-field engineer, has been named sales and service engineer for Hardy-Griffin Engineering Corp., Houston. Phillips most recently was a field operator for Lane-Wells Co. and had been with the firm 3 years. He joined Johnston Testers in 1941 as a field operator and soon after was promoted to the sales and service division.

Phillips then was named sales and service manager for Kansas and Oklahoma and his last assignment with Johnston was in the sales division in the Houston area.

Murphy Named to Brewster Sales Post

Henry J. Murphy, Jr., has been appointed sales representative for The Brewster Co., Shreveport, La., P. J. Parker, sales manager, has announced.

Included in Murphy's service to the oil-drilling field are 10 years as a sales and service engineer with Emsco Manufacturing Co. He also worked as an engineer with Universal Construction Co.

Weco Appoints Kansas Sales Representative

J. A. (Jim) McCreery has been appointed sales representative in Kansas by Well Equipment Manufacturing Corp., according to John W. Gates, sales manager, who has also announced creation of another sales territory.

Ted Stunkard, Weco representative from Kansas, is being transferred from Great Bend to Oklahoma City to serve southern Oklahoma, including Oklahoma City. Charley Gisler will remain in Tulsa as sales representative for northern Oklahoma.

McCreery, formerly sales representative in Oklahoma and Kansas for Continental Supply Co., will be headquartered at Great Bend. Before assuming his duties in Kansas, he completed a training program in the Weco plant at Houston.

Low-Cost Promotion Gets Top Results for Franklin

M. H. Sublett, Franklin Supply Co. store manager, fills a cooler preparatory to making a 75-mile delivery trip to a rig. In 1952 when Franklin Supply opened a store in West Casper, Wyo., Sublett gave out ice-cold Coca-Cola. The well-filled iced cooler is just as essential for a trip to a rig as the pig iron. After 4 years' experience using this low-cost-top-result promotion, Sublett is convinced there is none better.

Independent Exploration Names Service Coordinator

BRYCE B. CURRY

Bryce B. (Bo) Curry has joined Independent Exploration Co. as the firm's service coordinator. This is a new position with Independent Exploration and Curry will help organize the department. Announcement of this expansion was made by T. I. Harkins, president of Independent Exploration.

Curry will serve present clients and prospective users of Independent Exploration service in nontechnical executive matters.

Stewart & Stevenson Makes Sales, Service Assignments

Naming of A. J. (Andy) Houseman, Houston, as assistant to the chief engineer, and Richard T. Akeroyd, San Antonio, as sales engineer, has been made by Stewart & Stevenson Services, Inc. Louis E. Duncan is now on the sales staff for the Lubbock branch and Milton C. Marley is a service manager for the Corpus Christi branch.

Houseman most recently was a project engineer for Gibbs Corp., Jacksonville, Fla., and has had extensive design experience. Akeroyd conducted his own advertising service before joining Stewart & Stevenson. Most recently with Fairbanks, Morse & Co. as a diesel engineer, Marley has a broad background in service work.

Anderson Named Manager Of New GSI Department

R. W. ANDERSON

Russell W. Anderson has been named manager of the newly formed industrial engineering department of Geophysical Service, Inc. GSI Administrative Vice President E. O. Vetter said Anderson's duties would include cost estimating, cost analysis, and budget control. In addition, Anderson's department will be responsible for coordinating policies and procedures for GSI's organization. The industrial engineering department will also direct administration of a work-simplification program to be applied to field operations of GSI's geophysical exploration field parties.

Anderson joined GSI in 1948 as computer on a seismograph field party in West Texas. In 1951 he was assigned to the Dallas office as a cost analyst and was appointed cost control supervisor in 1953.

Houston Nomads Entertain Foreign, Domestic Guests

The December meeting of the Houston chapter of Nomads was attended by 80 Nomads and guests. Shown are: W. O. Calvert, manufacturer's representative, London, England; C. R. Williams, Pacific Northwest Pipeline Co., Houston; and O. B. Rylander, Perforaciones Guarico, C.A., Caracas, Venevuela. Other guests included Ben R.

Bourland, Baroid Division, Houston; John Lloyd, Stanolind Oil & Gas Co., Houston; Howard B. Book, Reed Roller Bit Co., Houston; R. J. Haslett, National Tube Division, Gary, Ind.; C. E. Pendock, National Tube Division, Houston; Joe Baker, Union Oil & Gas Co. of Louisiana, Houston; Hugh Patterson, Phillips Petroleum Co., Houston; Fred Hodson, oil attorney, Houston; E. E. Childress, Stewart & Stevenson, Houston; and E. D. Carney, Export Tool Co., New York.

At the meeting, Williams presented a motion picture showing laying of the 26-in. gas line from San Juan basin in New Mexico to the State of Washington.

Morte Joins Axelson as Hydrax District Sales Mgr.

George Morte has joined the hydraulic sales department of Axelson Manufacturing Co., division of U. S. Industries, Inc. J. W. Rockwell, sales manager, hydraulics, announced that Morte will serve as district sales manager, representing the Hydrax line of Axelson hydraulic pumping equipment in the Mid-Continent area. He will be located at the offices and hydraulic center in Odessa, Tex.

Promotions, Additions Announced by Weatherford

B. LOUDERBACK

Bill Louderback has been employed by Weatherford Oil Tool Co., Inc. as assistant public relations, advertising and training manager with headquarters in Houston. Recently employed as sales and service engineer for the Abilene district was L. Gene Posey. Tom McClelland is the new sales and service engineer for the Lafayette, La., district. H. E. Crocker has been promoted to district manager in the northern division with offices in Casper, Wyo. The new assistant northern division manager in Oklahoma City is Doss Hamilton.

Louderback most recently was associated with Permian Mud Service in Odessa. Posey worked several years in the oil fields on drilling crews. Until joining Weatherford, McClelland was a field salesman for Continental Supply Co. in Houma, La. Crocker has worked as a driller in Texas and Alaska. Hamilton formerly was sales and service engineer in Odessa.

Schlumberger Names Rusen As District Manager

S. John Rusen has been named manager of the Schlumberger Well Surveying Corp.'s district office at Grand Junction, Colo. Rusen joined Schlumberger in 1948 and has served as field engineer in several Rocky Mountain locations.

Delta Opens New Branch Appoints Pitts, Gilstrap

Establishment of a new oil-field equipment sales and stocking point in Houston and appointment of James R. Pitts and Ralph L. Gilstrap as sales engineers for Delta Tank Manufacturing Co., Inc.'s oil-field equipment division have been announced by Ross B. Baze, vice president.

Delta operates other oil-field equipment sales and stocking offices in Baton Rouge, Westwego, Lafayette and Bossier City, La., and in Laurel, Miss.

Pitts has been assigned to Delta's city sales office in Houston and Gilstrap will serve Delta customers in the Oklahoma City region.

MEASURING length of a hardened oil-well cement specimen following exposure to sodium sulphate solution at elevated temperatures similar to those obtained in wells. One of a series of laboratory tests which insure UNAFLO's consistent quality.

Quality control of UNAFLO* oil-well cement in lab insures top performance in field

- Painstaking care during manufacture pays off in down-the-well dependability of UNAFLO retarded oil-well cement.
- Slurries pump easily, stay fluid and pumpable under severe conditions of temperature and pressure.
- UNAFLO's *retarded set* gives vital extra time in emergencies, yet slurries form a strong, watertight, sulphate-resistant seal.

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* **"UNAFLO"** is the registered trademark of the retarded oil-well cement manufactured by Universal Atlas Cement Company

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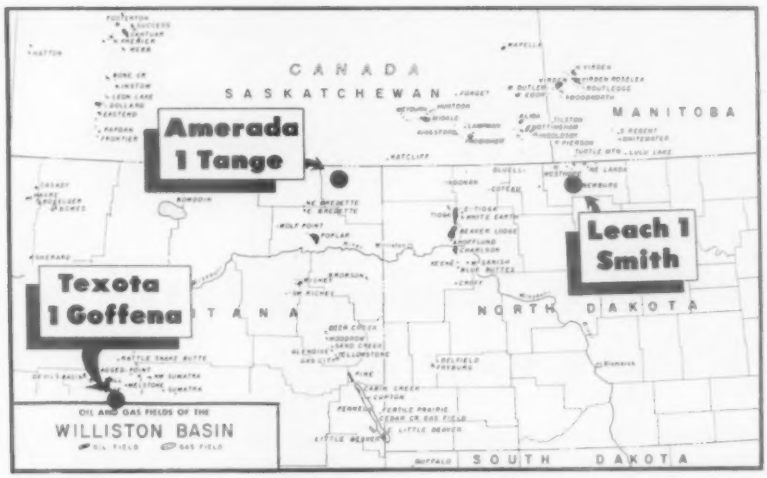
Three Strikes Give Rockies a Lift

by Frank J. Gardner



THREE YEAR-END DISCOVERIES in three different formations have drawn industry attention to Montana-North Dakota. (Base map courtesy Petroleum Information, Denver.)

THE trio of new discoveries pictured on this map provided a ringing climax to 1956 exploration activities in the Rocky Mountains. Probably, all of them will be completed this week, to give the new year a resounding sendoff.

A new reservoir in the north . . . The most important of the three, and possibly the most important discovery event of the year, next to Aneth, is Amerada Petroleum Corp. 1 Tange, located in Section 20-36n-53e, Sheridan County, Montana. As noted in this column a month ago, this new oil discovery is significant not only because of its position in the center of vast undrilled acreage, but because of the age of the reservoir it has tapped. It is the northernmost Silurian producer in the Williston basin, and gives Sheridan County its first commercial production. It lies 92 miles north-northeast of the nearest comparable Silurian production at Southwest Richey, in McCone County. Another 90-mile stretch of sparsely drilled country separates it from the prolific Nesson anticline fields in North Dakota. Nearest Canadian producer is Saskatchewan's Ratcliffe field, a Mississippian producer 40 miles to the northeast.

Amerada carried the 1 Tange to a total depth of 9,950 ft. and spent more than a month testing various intervals in the Ordovician before plugging back to 9,091 ft. for final completion in the Silurian at 9,056-74 ft., an interval that had shown commercial oil late in November. Final test of this interval was made last week, and 1 Tange went into the books for an initial potential of 2,742 bbl. per day on ½-in. choke. Gravity of the oil is 39.9°. Operators have shut the well in and have announced location for a new wildcat 4 miles southwest of the discovery at the 1 Loucks, in Section 35-36n-52e. If this one hits, the Outlook area (probable name of the new field) will be as hot as a firecracker, and Amerada can look forward to retrieving some of the millions it has sunk in a previously disappointing Montana campaign.

This flush Silurian strike so close to the Canadian border, 10 miles to the north, should perk up Canadian interest in this formation. Most of the amazing Saskatchewan drilling campaign of the past year was aimed at the Mississippian, and few tests have ever gone to the Silurian. Now, perhaps, operators throughout the northern reaches of Williston will want to take a look at deeper prospects. Nor should the impact of the Tange strike be lost on operators south of the border, for now the Silurian has proved itself, both here and on the Cedar Creek anticline, to be a prolific reservoir rock.

And a new field to the south . . . Second most important of the three discoveries pictured here is Texota Oil Co.'s 1 Goffena, in Section 26-9n-27e, Musselshell County, Montana. This one is now preparing to perforate and test, after having recovered 4,400 ft. of 40°-gravity oil on a test of the Amsden-Pennsylvanian at 6,278-94 ft. Texcta carried the hole to total depth of 6,309 ft., topping the Amsden at 6,247 ft.

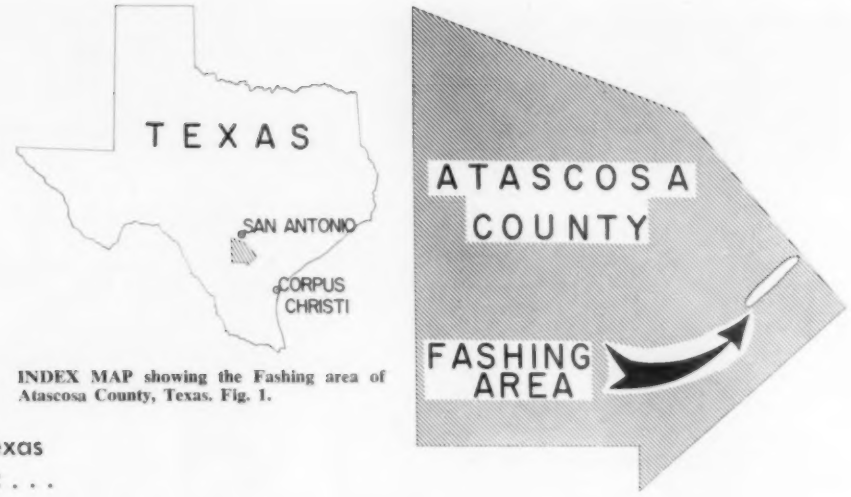
This new Montana success lies 25 miles northwest of Wolf Springs field, also an Amsden producer, and the best yet found, despite low-ultimate-recovery estimates. Prior to the Wolf Springs discovery, only three fields had recorded Amsden oil flows; these were Gage, Big Wall, and Northwest Sumatra.

The Texota well will draw new attention to the Amsden, however, as a major target for central Montana exploration. The fractured dolomite reservoir has drawn recovery estimates as low as 1,000 bbl. per acre at Wolf Springs, but with adequate spacing patterns, such fields can be made worth the search

Are important developments . . . Far to the east, in Bottineau County, North Dakota, Leach Oil Co. is running swab tests at a third discovery, the 1 Smith, in Section 14-162n-80w. Here, Leach is trying to open a Spearfish-Triassic field, second such reservoir for this area. On a drill-stem test at 3,425-30 ft., operators recovered 1,700 ft. of gas in the pipe, 35 ft. of oil-cut mud, and 350 ft. of gassy oil. Perforations were made at 3,425-33 ft. in the Spearfish, which was topped at 3,425 ft. The only other Spearfish producer is Newburg field, 9 miles southeast of the Leach well.

All these developments are important. The two discoveries in the Williston basin are especially so, because at this crucial time in Williston history, when vast acreage holdings are soon coming up for renewal, the basin must prove its worth or suffer the consequences of exploration rigor mortis.

End.



INDEX MAP showing the Fashing area of Atascosa County, Texas. Fig. 1.

Here's how one South Texas operator found a prolific . . .

Deep Edwards Reservoir in "Shallow Country"

by Robert M. Knebel

DOES the deep Edwards area, of Atascosa County, Texas, have a major oil and distillate producing future? Lone Star Producing Co. believes that the Edwards fields will be of commercial value if:

1. They are properly situated geographically.

2. They contain an indicated minimum reserve of 30 billion cubic feet or more of gas.

3. They have other reservoir characteristics similar to those found in Pleasanton and nearby fields. The Fashing area, of Atascosa County, Texas, is about 50 miles south and slightly east of San Antonio. See Fig. 1.

With these criteria in mind Lone Star has been actively searching for such reservoirs in this general area for several years. This search has been an effort to increase the future marketability of Pleasanton gas reserves.

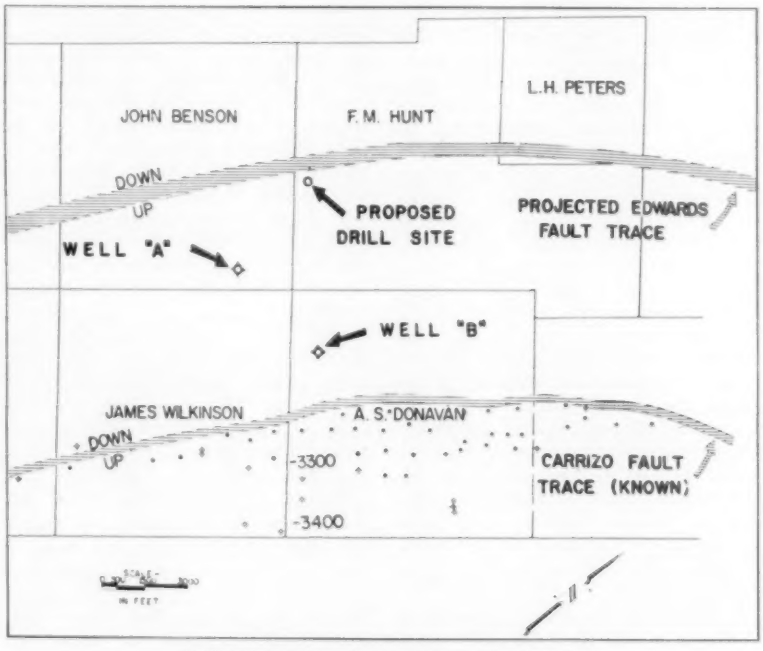
During the search, they found that closure was present in the Fashing area on a known fault zone having a throw of approximately 300 ft. at the 3,700-ft. or Carrizo-Wilcox level. Closure at this depth was proved by Carrizo oil production. Absence of Edwards production against the Edwards trace of this fault was conspicuous and inconsistent with other similar situations in the county.

In general, if an accumulation of oil and/or gas is found in one bed on the upthrown side of an up-to-the-coast fault in this area, and if that fault is the dominant sealing factor, drilling usually reveals additional producing zones in the same fault block.

This concept certainly is not new, but it led to the Edwards discovery at Fashing and probably will be responsible for locating many similar fields in the future.

Fashing fault . . . Study of the Fashing block revealed that dry holes B and A (Fig. 2) cut the Fashing fault 4,000 and 1,700 ft. respectively above the Edwards, and that apparent displacement amounted to about 460 and 370 ft. in these instances. Dry hole A had gas shows in the upper 90 ft. of Edwards, and it was believed that 75 ft. of structure could be gained by a well

Author is district geologist, Lone Star Producing Co., San Antonio. Paper presented at the sixth annual meeting of the Gulf Coast Association of Geological Societies, San Antonio, 1956.



PROSPECT map prior to seismograph. Fig. 2.

THE WEATHERFORD TECHNIQUE

Timing is vital

when running and cementing casing

Poor timing can mean a costly remedial job, loss of oil, or a possible blowout. From the moment the drill pipe is laid down until the cement sets in place behind the casing, timing is critical.

For example, mud should not be allowed to set, uncirculated, in the uncased hole too long. The longer the delay, the more pressure is required to overcome the inertia of the thickened mud column, and the greater the danger of upsetting the delicate balance between mud weight and formation pressures. Hence, the need to keep elapsed time at minimum, the need for speed when making up the cement head and prefitting the casing with properly spaced reversible scratchers and centralizers.

When running casing, too, timing is vital. It must not be run faster than the mud column can be displaced, (because of destructive hydraulic pressure surges), yet if it is run too slow, valuable rig time is wasted. Stopping casing movement can cause gelled mud, drill cuttings and sloughings to pack off against the pipe and stick it. To avoid these dangers, casing must be run in one smooth operation.

After scratcher and centralizer-equipped casing is run, it must be reciprocated long enough to remove all excess hole growth, and until gelled mud and cuttings are circulated out. In certain wells this can take up to several hours. Here again timing is vital.

The Weatherford Technique, using Weatherford equipment, is your best assurance of a well-timed casing operation and a better cement job. Call the man from Weatherford.

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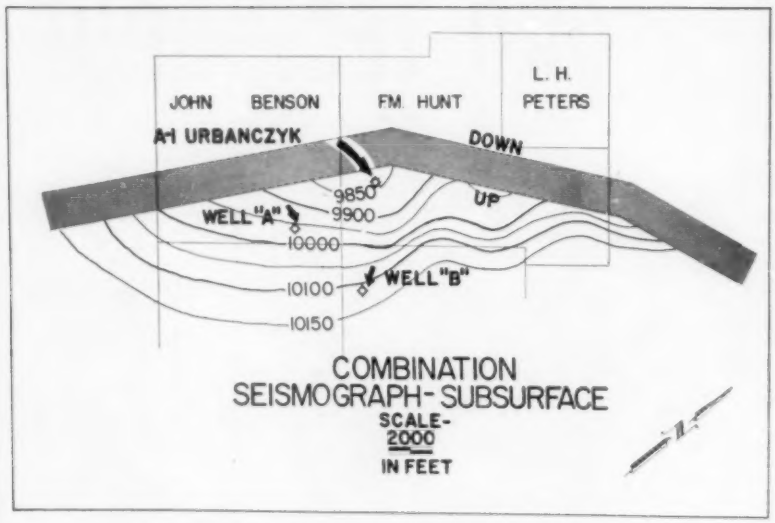
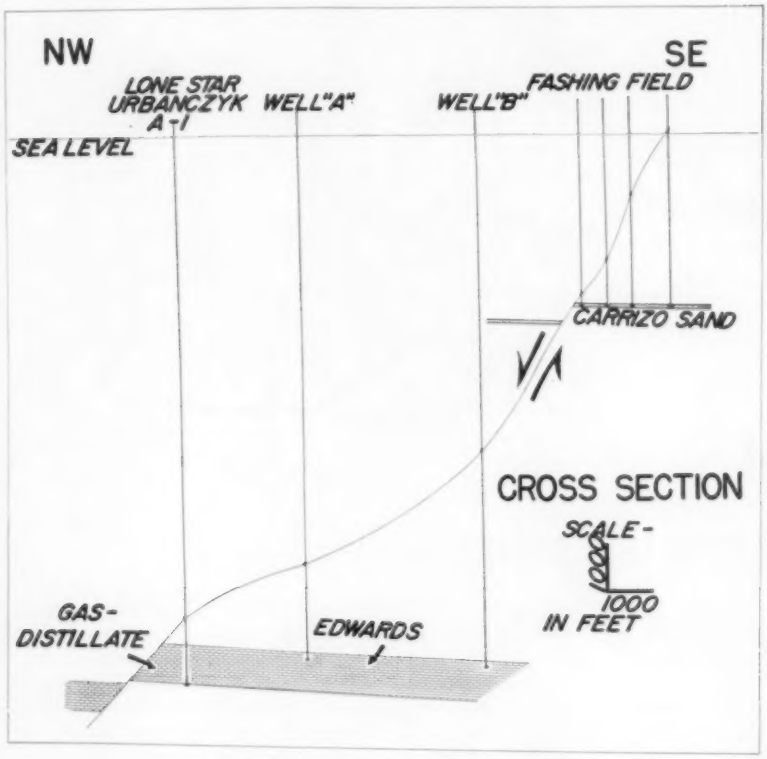


COMBINATION MAP shows the location of dry holes. Fig. 3.



CROSS-SECTION of the Fashing area. Fig. 4.

located in a northerly direction from well A without placing such a location in hazardous proximity to the fault zone.

A well at such a location appeared to offer about 165 ft. of vertical closure in the Edwards, which if true, should provide a trap of commercial value. Fig. 2 illustrates the way known facts were assembled prior to seismic work.

After acquisition of the desirable leases, the seismic survey, recommended as worthwhile prior to final location of the initial test, was completed in May 1956. The combination map, resulting from subsurface and seismic work, is designated as Fig. 3 and also shows the location of dry holes A and B and Lone Star's 1 Urbanczyk well.

In drilling the initial Urbanczyk test, coring was begun immediately above the top of the Edwards, encountered at 10,210 ft. Cores from the Edwards lime section totaling about 580 ft., and 69 ft. of additional cores with inferior porosity, in the lower section, were analyzed. They were described by the laboratory as productive of gas, and/or oil, or distillate.

Subsequent production tests of a 10-ft. section at 10,420-30 ft. showed large-volume gas-producing capacity with a distillate content of about 16 bbl. per million cubic feet.

A subsequent production test through perforations from 10,790 to 10,850 ft. showed large-volume gas-producing capacity. It flowed at 5,058 M.c.f.d. of gas through ¼-in. surface choke with tubing pressure of 3,500 psi. Light straw-colored distillate accompanied the gas from this lower interval in the amount of about 24 bbl. per million cubic feet.

Survey . . . The electric and MicroLog survey was corroborated by taped measurements of porous sections in the cores. More than three-fifths of each core was actually porous. This measurement included good, vugular, trace, pinpoint, and earthy types of porosity.

The cores exhibited fracturing in varying degrees. This characteristic is considered largely responsible for difficulties encountered in coring the lower portion of the interval penetrated.

While speculation regarding possible gas reserves in this undefined trap remains at least a popular pastime for personnel within our organization, it is interesting to hear from our engineers that 1,000 acres having reservoir characteristics comparable to those at the Urbanczyk location would assure reserves in excess of 400 billion cubic feet.

Conclusions

1. Where the fault is the primary sealing factor, production from one bed along this fault is indirect evidence of closures on the other beds, both shallower and deeper.

2. The MicroLog of the Edwards lime in the discovery well optimistically recorded both effective and ineffective porosity as equal in importance.

3. According to the seismograph work, the throw of the fault near the discovery well was about 800 ft. This interpretation places the Edwards on the upthrown side against the Austin-Georgetown section on the downthrown side of the fault. It would then seem that a displacement sufficiently great to move Edwards against Taylor shale is not prerequisite for Edwards production. **End.**

EXPLORATION HIGHLIGHTS

MID-CONTINENT

OKLAHOMA

Noble Discovery Has High Oil Flow Rate

Anderson-Prichard Oil Corp. 1 Allison, Noble townsite discovery in NE NE SW 27-8n-2w, Cleveland County, flowed 345 bbl. of oil in 19 hours from the Tulip Creek sand at 8,210-15 ft. on 24/64-in. choke. Flow from the Bromide sand was 225 bbl. of oil in 19 hours on 11/64-in. choke from perforations at 7,900-05 ft. The operator has not yet tested the middle McLish sands.

Outpost Completed at Southwest Ponca City

Tidewater Oil Co. 1 Four Bear, outpost well at Southwest Ponca City field in Kay County, was completed flowing 14 bbl. of oil per hour or the daily rate of 336 bbl. from Skinner sand at 3,780-89 ft. on 11/64-in. choke.

Moore Outpost Well Completed in Cleveland

Lone Star Producing Co. 1 Lindsay, outpost well southwest of Moore townsite in Cleveland County, flowed 336 bbl. of oil in 24 hours on 20/64-in. choke from perforations in the Hunton lime at 7,658-7,720 ft.

Short Junction Adds Dual Producer

A dual completion was reported in Cleveland County's Short Junction field. Anderson-Prichard Oil Corp. 1 Elizabeth, NW NE 20-10n-3w, flowed 30 bbl. per hour on initial flow from Hunton lime at 7,778-7,836 ft.; final flow netted 138 bbl. in 17 hours on 16/64-in. choke. Oil flow from the unconformity sand at 7,693-7,701 ft. was 20 bbl. per hour initially and 192 bbl. in 17½ hours on final flow test on 16/64-in. choke.

New Pay Discovery at Royal Pool in Garvin

The upper Bromide sand is a new-pay discovery for Royal pool, Garvin County. The discovery well is Shell Oil Co. 1 Cole-Cook Unit, C SW SE 5-1n-3w. The well flowed 135 bbl. of load oil and 12 bbl. new oil in 12 hours on ½-in. choke from deep perforations at 11,588-11,610 ft. It then made 302 bbl. in 24 hours on 1-in. opening. The operator then tested on ¼-in. choke, making 126 bbl. in 19½ hours.

Early in 1956 Shell 1 Johnson, C SE NW 5-1n-3w, was a deep upper McLish discovery at 13,002-32 ft. That well flowed 249 bbl. of oil in 8 hours on ½-in. choke. The pool's main pay zone is at a shallow 3,000-ft. mark.

West Maysville Pool Extended in Garvin

Superior Oil Co. extended West Maysfield pool in Garvin County at another Bromide sand well, the 1-7 Rollow, C SE NE 7-4n-2w. This well links the field with Southeast Story.

The well flowed on tests at the rate of 36 bbl. hourly from Bromide sand at 7,335-64 ft.

Completion Due at Northeast Moore Well

An-Son Petroleum Co. and Hershey Oil Co. 1 Turner, Northeast Moore field well in Cleveland County, C SE NE 14-10n-3w, flowed 353 bbl. of new oil, natural, in 19 hours on 18/64-in. choke from perforations in the Bartlesville sand at 7,446-7,508 ft.; the well is now testing in the Hunton lime at 7,592-7,678 ft.

Two Dutcher Sand Wells Added to Newby in Creek

Northeastern Oklahoma developments included the addition of two good wells to Newby field in Creek County.

O. F. Warren Exploration Co. 8 Kelly-Fogle, NE NW NE 10-14n-9e, flowed 20 bbl. of oil per hour on ¼-in. choke from 3,050-72 ft.; the 1 Knapp, SE SW SE 3, made 15 bbl. per hour at 3,045-57 ft.

Northeast Enid Pool Moves Northwest

The growing second Wilcox sand campaign in Garfield County's Northeast Enid field continues to move northwest. The Texas Co. 1 Voth, NE SW SE 15-23n-6w, flowed 296 bbl. of oil per day, natural, on 12/64-in. choke from perforations at 6,920-28 ft. Another well in the expansion area, Champlin 1 Regier, SW SW SW 14-23n-6w, made 166 bbl. in 14 hours on ⅛-in. choke from open hole at 6,908-20 ft.

Prolific Wilcox Well Finalled at West Dale

A big Wilcox well, the third in West Dale pool, Pottawatomie County, was completed by Warren Petroleum Corp.

The 1 Rooker, SE SW NE 27-11n-2e, flowed 45 bbl. of oil per hour on natural test through open hole in the Wilcox at 5,852-58 ft. This is a daily rate of 1,080 bbl.

Second Offset Success Reported at Northeast Payne

The second offset well in Northeast Payne pool, McClain County, is a success. Atlantic Refining Co. 1 Little, C SW NE 4-5n-3w, flowed as much as 120 bbl. of oil per hour on tests of the Bromide sand at 9,637-78 ft. Sinclair 1 Little, C NE SW 4, flowed 60 bbl. per hour from the same pay sand.

KANSAS

Casing Set at New Harvey County Strike

Bennett & Gould have set casing at their indicated discovery in northern Harvey County, the 1 Mennonite Church, SW SW SE 23-22s-2w, 1 mile south of Sperling field and 4 miles west of Hesston, Kans.

A drill-stem test in the Viola at 3,390-3,400 ft. recovered 270 ft. of free oil in 1 hour. A test in the Mississippian at 2,955-3,012 ft. gaged 1,026 M.c.f. of gas.

Testing Under Way at Decatur Prospect

Cities Service Oil Co. 1 Cathcart, SE SW SE 17-1s-27w, 3 miles southwest of Warner pool in northern Decatur County, northwestern Kansas, pumped 26 bbl. of oil in 24 hours from perforations in the Lansing. Success at this wildcat will open another pool on the flanks of the southwestern end of the Cambridge arch.

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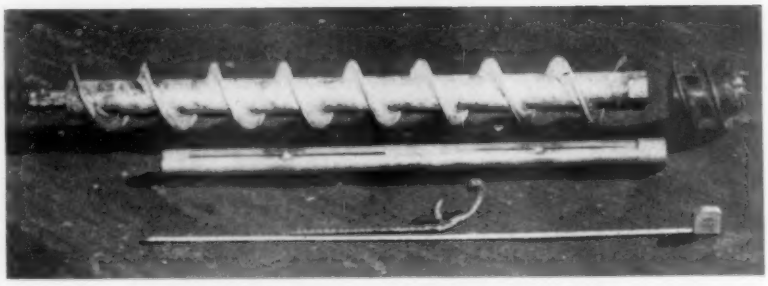
Jeep-Mounted Auger Drill Ready for Field Geologist

. . . cost per foot is only 50 cents

AUGER DRILL is mounted on a four-wheel-drive Jeep. Fig. 1.



CORE BARREL requires no circulating fluid. Fig. 2.

BACK-BREAKING digging for near-surface geological samples is eliminated with the newly designed Jeep-mounted auger drill.

Shell Oil Co. has developed a portable drill that . . .

- Is mobile and can traverse rough terrain.
- Penetrates all formations from soft to very hard.
- Drills a 6-in. hole 50 ft. deep and can go to 100 ft. with slight modifications.
- Cuts short cores for stratigraphic information.
- Operates normally without fluid circulation.

Shell's San Joaquin division exploration department felt the need for a portable type of drill that would assist the field geologist in locating subsoil contacts and obtain samples for stratigraphic control. In the past, the field geologist or his assistant had to dig for these samples; a time-consuming, costly, and laborious task.

Engineers with the company studied the problem and recommended the purchase of a mobile drill manufactured by Mobile Drilling, Inc., Indianapolis. This auger type of drill was mounted on a Willys Overland four-wheel drive Jeep (Fig. 1).

A core barrel was designed and built (Fig. 2) that required no circulating fluid. Normally the core barrel will recover about 50 per cent of the interval cut. This is considered adequate for the needs of the exploration department.

Cheap drilling . . . Total cost of the Jeep, drill, and associated equipment is approximately $5,600. Daily operating cost of the rig is $70, using a two-man crew. The elimination of hand digging and the better stratigraphic samples obtained are ample justification for the use of the new drill.

During one period of field operations, the unit averaged six holes per day for a total daily footage of 140 ft. Cost per foot was approximately 50 cents. Hole depths varied from 8 to 50 ft. Penetration rates ranged from 16 to 53 ft. per hour.

Deeper drilling . . . The augers can be replaced with diamond drill rod, using either water or air as the circulating medium. This conversion extends the drilling range to 100 ft. Daily operating costs, however, are increased because of the need for either a water pump or an air compressor.

The auger type of drill also can be used for shot-hole drilling in seismic operations where only shallow holes are needed.

KANSAS

Flowing Oil Discovery Reported in Barber

Aylward Drilling Co. has set casing at 1 Walker, flowing oil strike in northwestern Barber County, SE SE NE 21-30s-15w, 1 mile northwest of Sun City field.

The well flowed oil on drill-stem test at 4,557-71 ft. in the Viola.

NORTH TEXAS

Extension Well Finalled

W. F. Holmes 1-N Petrex, northern Archer County well 1½ miles southeast of Holliday and ¼ mile southwest of production, was completed on pump for 108 bbl. of oil per day. Gravity is 43°. This well is in Block 126, ATNCL Subdivision.

Gage Taken at Fisher Offset Well

Ada Oil Co. 2-B Sam Swann, 7 miles northeast of Eskota in Fisher County, the southwest offset to a reef oil discovery, flowed 168 bbl. of oil on 20-hour test through perforations at 4,420-32 ft. on 10/64-in. choke. This well is in an unnamed new area in the northwest corner of R. S. Spires Survey 283 and 933 ft. southwest of the discovery well of the area, the 1-B Swann.

Strawn Sand Oil Strike in Clay

Southwestern Clay County has a new Strawn producing area, 3½ miles southeast of Scotland and 3 miles west of production. The discovery well is Bridwell Oil Co. 1 Lorena Kinder, Section 2, Block 2, Clark & Plumb Subdivision. The well pumped 46.34 bbl. of 41°-gravity oil per day from perforations at 4,613-19 ft.

New Gas Pool Opens In Parker County

Ben J. Taylor 1 S. F. Stevens, north-central Parker County, is a gas discovery in shale and lime. The well, 8 miles north of Weatherford gas production, flowed an estimated 2,000 M.c.f. of gas per day at 2,800 ft. Location is in Section 173, T&P Survey.

Wichita County Strike Completed

W. A. Lofton 2-DD W. T. Waggoner, 1 mile east of Iowa Park in Wichita County, was completed on pump for 124 bbl. of oil per day. Perforations were at 4,127-52 ft. Gravity is 40°. Location is in Block 27, Tarrant County School Land Survey.

Potential Reported at Jack County Discovery

Nash Oil Co. 1 O. E. Ross, Jack County discovery well, 10 miles southwest of Jacksboro in R. Rinney Survey, A-1197, flowed 144 bbl. of 40°-gravity oil per day from perforations at 2,870-75 ft. on calculated potential. Top of pay is 2,870 ft.

Potential Made at Young County Strike

L. T. Burns Estate 2 Hightower, northwestern Young County Mississippian discovery, has been officially potentialed for 133 bbl. of 44°-gravity oil per day on 6/64-in. choke. Perforations are in the Mississippian at 5,136-39 ft.

Location of this pool is 4 miles west of Olney in TE&L Survey 190 A-437.

SOUTH TEXAS

SOUTHWEST TEXAS

Oil Strike Takes Potential in Hidalgo

Hargrave Oil Corp. et al 2 Max Lutz was completed for an official gage of 99.90 bbl. of 52°-gravity oil daily from perforations at 7,220-32 ft., opening a new oil pool in Hidalgo County. The well flowed on 16/64-in. choke. Location is 5 miles northwest of Edinburg townsite. Pay is Frio-Vicksburg.

Cage Ranch Wildcat Is Gas Discovery

Associated Oil & Gas Co. 5 J. L. Cage "B," Cage Ranch area of Brooks County, is a gas discovery at 7,156-66 ft. The well flowed 10,000 M.c.f. of gas per day on completion. Location is 7½ miles southwest of Falfurrias townsite.

Biel Field Production Confirmed in Webb

Weaver & Sharp completed the 2 and 3 Emil Biel wells, confirming production from the 1,000-ft. sand in newly opened Biel field, 44 miles northeast of Laredo in Webb County.

The 2 Biel, 660 ft. northeast of the No. 1 oil discovery well, finaled for 41 bbl. of oil per day from open hole at 993-97 ft. Gravity is 22.3°. The No. 3 well pumped 40 bbl. of 22.3°-

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gravity oil per day from open hole at 1,008-11 ft. The discovery well of this field was completed last autumn for 16 bbl. of oil per day from open hole at 1,001-04 ft. The field is in Survey 2403.

TEXAS GULF COAST

New Oil Sand at Appling Field

Crown Central Petroleum Corp. et al and Alcoa 2 Gustav E. Peterson was completed in Jackson County's Appling gas area. The oil discovery is the Middle Kopnicky Segment "D." The well flowed from perforations at 8,658-59 ft. at the rate of 186 bbl. of 36.6°-gravity oil daily. Location is 10 miles east of Point Comfort in Samuel C. Lyons Survey, Abstract 212.

SOUTH LOUISIANA

Completion Reported at Jefferson Oil Strike

An oil discovery has been completed 2 miles southeast of Little Lake field production in Jefferson Parish by Richardson & Bass.

The 1 Humble-LL&E McCall Island, 14-18s-23e, flowed 366 bbl. of oil per day on potential test. Perforations were at 13,178-85 ft. in the lower Miocene sand. From a 7/64-in. choke the well flowed 366 bbl., gravity 32.4°. The No. 2 well will begin immediately.

Production Confirmed at Simon Pass Wildcat

The Simon Pass area production has been confirmed by The California Co. The 1 State Lease 2810, 1 mile northwest of the discovery well in St. Martin Parish, flowed 98 bbl. of 61.2°-gravity distillate with 4,555 M.c.f. of gas per day on 12/64-in. choke from perforations at 14-069-14,102 ft. The discovery area is on the north shore of Six Mile-Flat Lake, 21-15s-12e.

New Pay Well Completed At Bayou Postillion

Humble Oil & Refining Co. ran potential gage at the 1 Mrs. Jennie Kyle McKerrall, 36-12s-11e, in the Bayou Postillion area of Iberia Parish. The well flowed 127 bbl. of 37.6°-gravity oil per day on small choke from perforations at 11,708-17 ft.

● Sunray Mid-Continent Oil Co. has completed a high pressure gas well in South Duson field in Lafayette Parish, as a confirmation test to its recent 1 Bolo-Mex zone discovery. The well, 5 Mary McConnell, flowed at the rate of 2,600,000 cu. ft. of gas and 7 bbl. of distillate a day after perforations from 13,274 to 13,287 ft.

The well, located 660 feet from the south line and 1,980 ft. from the west line of 8-10s-3e, is a confirmation to the zone's discovery well, the 1 W. W. Brunner, located ¼-mile north.

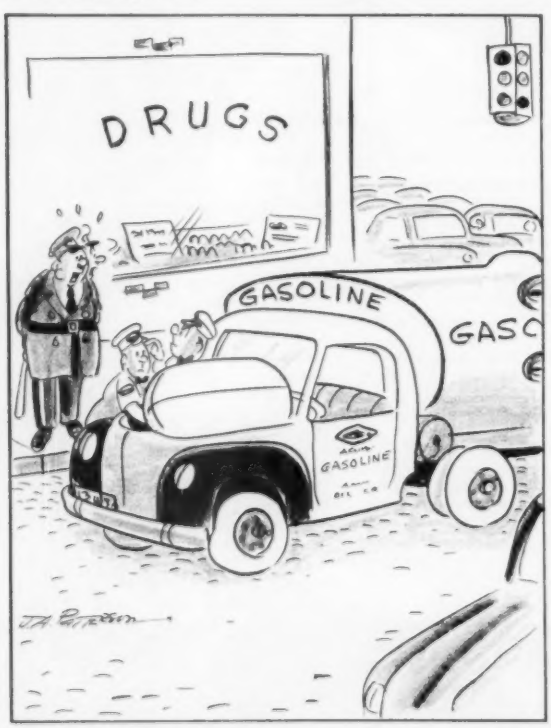
First Oil Production at Lake Fortuna Gas Field

First oil production was opened in Lake Fortuna gas field, St. Bernard Parish, by O'Meara Brothers 3 State Lease 2192. The well flowed at the rate of 120 bbl. of 25.8°-gravity oil per day on 8/64-in. choke from perforations in sand at 6,471-6,500 ft. All other production at Lake Fortuna field is gas-distillate.

Union Extends East Lake Palourde Field

Union Oil Co. of California extended East Lake Palourde field northwest at 4-A P. R. Norman et al, 1½ miles from production in Assumption Parish. The gas-distillate well flowed 175 bbl. plus 5,005 M.c.f. of gas per day on 16/64-in. choke. Perforations are at 12,554-85 ft. The well is an old dry hole reentered.

THE OIL AND GAS JOURNAL



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New Oklahoma Maps Available

. . . Regional cross-sections completed

THE Ardmore Geological Society has recently completed a set of four regional stratigraphic cross-sections. This index map shows the location of these sections. For years the need for such a group of southern Oklahoma stratigraphic cross-sections has been recognized, and the Ardmore society appointed a seven-man committee to carry out the project. All members were experienced southern Oklahoma geologists and represented five major companies and two independents.

These sections will prove invaluable to geologists working in the area and will serve to clarify and standardize nomenclature in southern Oklahoma. The sections show the electric logs and are available in two scales:

Vertical scale, 1 in. equals 400 ft.

Horizontal scale, 1 in. equals 4,000 ft.

Approximate size of each section, 42 by 60 in.

And:

Vertical scale, 1 in. equals 800 ft.

Horizontal scale, 1 in. equals 8,000 ft.

Approximate size of each section, 21 by 30 in.

Further details can be obtained from Jerry L. Womack, Ardmore Geological Society, Box 958, Ardmore, Okla.

INDEX MAP shows the location of regional cross-sections.

APPALACHIAN

PENNSYLVANIA

In Young Township, Indiana County, southwest Pennsylvania, T. W. Phillips Gas & Oil Co. 3 Fee (Neal surface) wildcat, gaged 2,595,000 cu. ft., gas after fracture, Tully 6,850 ft., Onondaga 7,398 ft., chert 7,415 ft., gas 7,424-47 ft., TD 7,585 ft.

● New York State Natural Gas Corp. N-522 Florence Bodin, shut down at 7,381 ft., to fracture. Onondaga was at 7,198 ft., chert 7,214 ft., Oriskany sand 7,352-80 ft., gas at 7,364 ft., testing 400,000 cu. ft.

● In Armstrong Township, Peoples Natural Gas Co. 4108 ran casing at 7,443 ft. The Tully was at 6,859 ft., and the chert at 7,443 ft.

EASTERN KENTUCKY

In the Pike County sector of Big Sandy gas field, Kentucky West Virginia Gas Co. have completed 1059 Lizzie Potter as a Devonian shale gas well. Located on Shelby Creek, test gaged after shot, at the rate of 238,000 cu. ft. of gas daily. Top of shale was found at 3,549 ft. and penetrated to a total depth of 4,211 ft. A rock pressure of 457 psi. in 36 hours was recorded after shooting formation with 6,625 lb. of gelatin.

GREAT LAKES

MICHIGAN

A new Traverse oil discovery appeared at Ford Oil Co. 1 Williams-Richmond Comm., SE SE NE 34-16n-15w, Colfax Township, Oceana County, where a top Traverse oil pay was logged that flowed out of control gushing oil twice the height of the drilling machine before it was brought under control. Well flowed an estimated 50 to 75 bbl. of oil to pits and an additional 100 bbl. of clean oil to tanks in a short period before attempts were made to kill flow in preparation for running long string of 5-in. casing. First attempt to kill flow with water and mud failed when well headed up and cleaned itself. Additional mud and salt water were pumped into formation and flow was subdued. Long string of casing was set and hole as yet has not been cleaned out.

This new prospective discovery, described by many observers as one of the strongest Traverse wells ever witnessed in Michigan, logged top of Traverse lime at 2,026 ft. Pay was drilled between 2,032-35 ft., present total depth.

The 1 Williams-Richmond Comm. is structurally higher by 7 to 24 ft. over

correlating control points that virtually ring the discovery in every direction within a half mile. However, geologist estimate that area might develop into one covering from 300 to 640 productive acres. In addition, the other highest dry hole control point in the area was quit in the Traverse, leaving the prospect of another pay horizon in the Dundee-Reed City zone, yet unexplored completely, but encouraging.

The bulk of the desirable acreage around this wildcat is owned by Ford Oil Co. and Socony Mobil Oil Co., Inc. Socony has a location chosen for its first test in the area, the diagonal northeast 20-acre offset to this discovery, in the NW SW NW 35-16n-15w.

WEST TEXAS-NEW MEXICO

WEST CENTRAL TEXAS

Canyon to Be Tested At Fisher Wildcat

Good Earth Oil & Gas, Inc., will test the Canyon section at 5,241-70 ft. at the 1 W. E. Keener, indicated strike in Central Fisher County, 6 miles northwest of Roby.

Recovery on a drill-stem test at 5,055-67 ft. was 1,128 ft. of oil, 279 ft. heavily oil and gas-cut mud. Another test at 5,340-54 ft. recovered 3,350 ft. of gas and 42 ft. slightly oil and gas-cut mud. Location is in Section 37, Block 2, H&TC Survey.

WEST TEXAS

Upton County Strike Finalled By Gulf

Gulf Oil Corp. completed 1-F McElroy Ranch Co., 17-42-5s-T&P, Pennsylvanian discovery, 10 miles northeast of Crane and 3¼ miles north of Texel multipay field in Upton County.

Daily flowing potential was 311 bbl. of 41.2°-gravity oil. Production is on ¼-in. choke from perforations at 9,450-9,500 ft.

Oil Well Completed At Halley Field

Sunray Mid-Continent Oil Co. has finaled its 7 M. J. Hill in Halley field, Winkler County, as an oil producer in the Devonian zone. On a potential test, the well flowed at the rate of 378 bbl. of oil a day through a 14/64-in. choke. Tubing pressure was 1,650 lb. Perforations were made from 9,888 to 9,907 ft. The well is locted in the SW¼ of Section 19, Block 11, PSL Survey.

SOUTHEAST NEW MEXICO

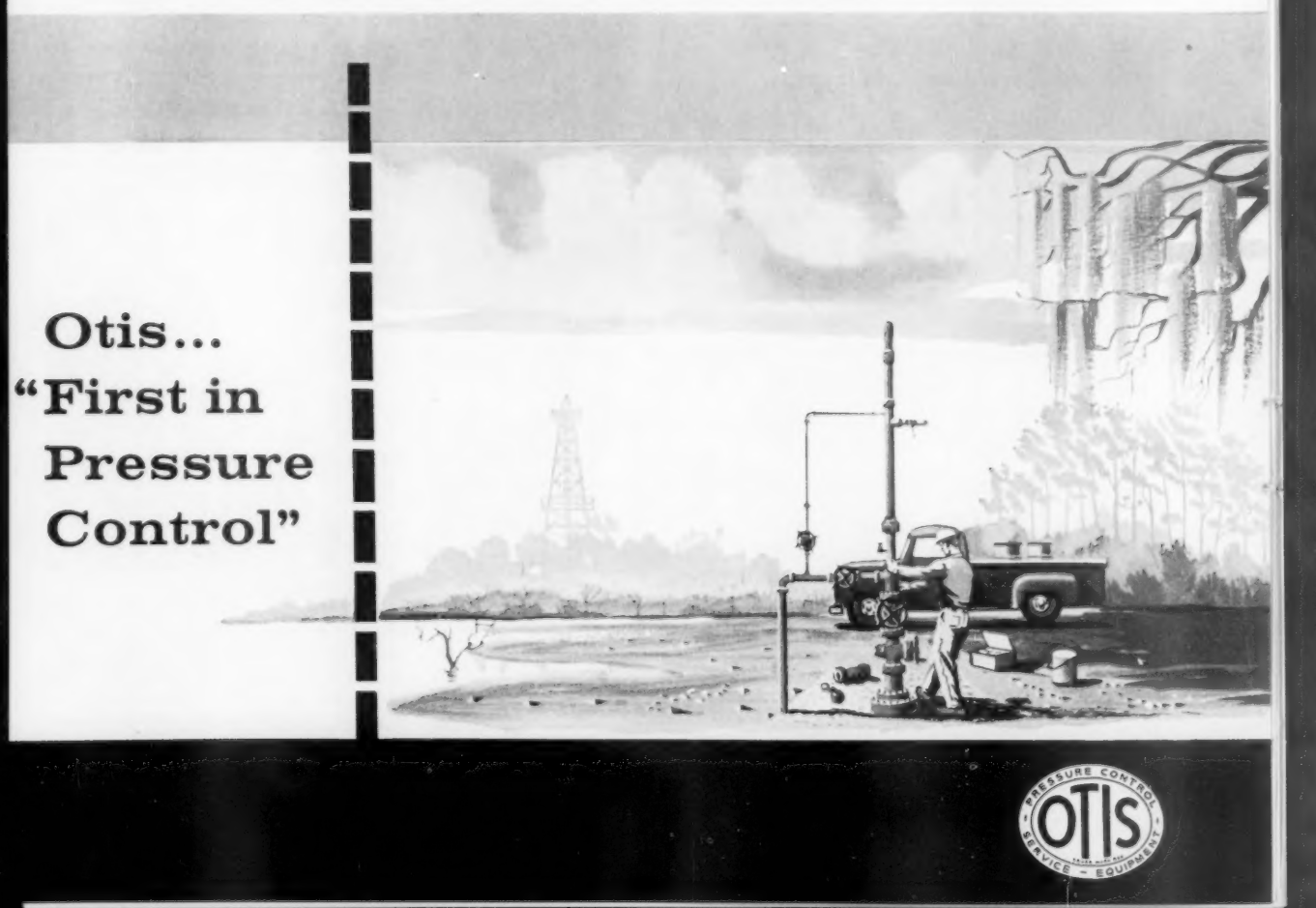
Sunray Mid-Continent Oil Co. has completed the 1-M. Powell as a producer in the Gladolia area in Lea County with a potential of 384 bbl. of oil a day through a 12/64-in. choke. Tubing pressure was 700 lb. The well, located in 18-12s-38e, was completed following perforations from 11,984 to 11,966 ft. in the Devonian zone. Sunray is currently drilling two other wells in the Gladiola area.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Morrow Discovery Finaled in Ochiltree

Sharples Oil Corp. completed its 1 Thompson in northwestern Ochiltree County as an upper Morrow gas producer from perforations at 7,372-88 ft. Flow was 3,500 M.c.f. of gas per day on 26/64-in. choke and 12 bbl. condensate per million. Location is 9 miles northwest of Perryton, Tex.



WESTERN CANADA

SASKATCHEWAN

Discovery Due Weyburn Area

A team headed by Trans Empire Oils, Ltd., and including Bailey Selburn Oil & Gas, Ltd., and Canadian Superior Oil of California, Ltd., is currently running production casing at an exploratory hole in the Weyburn district of southeastern Saskatchewan. Cores and drill-stem test information garnered from the well indicated oil production in the Mississippian limestone and further tests will be run in the near future to fully determine its commercial worth. The well, Trans Empire-Baysel-Canadian Superior 4-25 Weyburn, lies about 4 miles southwest of the closest production in Midale oil field and is 7 miles southeast of oil producers in the main Weyburn field.

Weyburn No. 4-25, LSD 4, 25-5-12w2, the discovery hole, had three tests run on it which covered a 90-ft. section. The initial two of those evaluations gave up oil-cut mud recoveries with the third giving up only mud and a trace of salt water.

● Another hole in southeast Saskatchewan, drilled by Imperial Oil, Ltd., on farmout rights obtained from Canadian Superior Oil of California, Ltd., has been completed as an oil well from Mission Canyon sector of the Mississippian. This well, Imperial Canadian Superior 3-27 Stoughton, was drilled earlier this year and was taken down as a "deep test." It was then plugged back to the Mission Canyon zone area around the 4,300-ft. mark and production casing was run. A section in the casing was perforated and the well put out an average of 51 bbl. of oil per day, cut 4 per cent with b.s. and w.

This test was drilled on LSD 3, 27-8-8w2, ½ mile southeast of Stoughton townsite, 16 miles northeast of the main development sector of Midale oil field and 37 miles east of Weyburn town.

ALBERTA

Gas Success Indicated at Wessex

Texaco Exploration's A6-24 Wessex wildcat venture in the Carstairs-Crossfield area of southern Alberta, 26 miles north of Calgary city limits being drilled on farmout acreage acquired from Canadian Superior Oil of California and Home Oil Co., has indicated gas success in the basal Blairmore during a drill-stem test run at the hole. Natural gas reached the surface at a maximum rate of 5,000,000 cu. ft. daily and then decreased to an estimated 500,000 cu. ft. daily when fluid entered the pipe.

The well is situated on LSD 6, 24-29-2w5, 8½ miles north of the Shell A13-2 Crossfield Cardium oil discovery well, and the same approximate distance southwest of Shell 7 Olds suspended exploratory venture. During the drill-stem test run in the basal Blairmore, around the 8,100-ft. level, maximum flow rate was established after the valve had been open 20 minutes. Pipe recovery consisted of 750 ft. of gas-cut mud.

The A6-24 Wessex was carried to completion depth in the Mississippian formation and after failing to find production in that horizon was plugged back for this test. A further test higher in the Blairmore is being conducted at the present time.

Report on Western Canadian Oil

By Carl O. Nickle, M.P.

Western Canada's oil and gas industry—whose headquarters in Calgary are a major factor in this city's economy—set new records again in 1956, just as it has each year for a decade, and

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The tool consists of a fluid chamber, a special temperature-controlled release mechanism for the fluid valve, and a rubber element which wipes the inside of the tubing and also smears the chemical on the wall of the pipe. The fluid chamber is separated by a ball joint so that the tool will pass through dog legs or crooked tubing. A small lubricator, made up on the tree, is used to run the tool in and to catch the assembly automatically after it flows to the surface.

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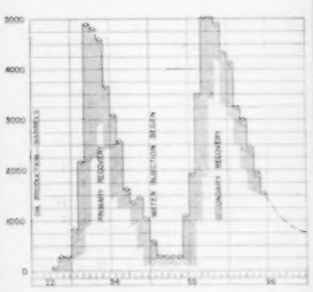
OIL PRODUCTION DECLINE CURVE due to Water Injection



Texas Water Flood, Callahan County,

REPRESSURING WITH GAS OR WATER

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

in the year ahead will again experience the biggest 12 months in its history. Here in brief is what happened the past year, and what lies ahead:

Wellhead gross revenue from petroleum liquids totalled about $404,000,000 for 1956 (up from $307,000,000 in 1955)—and will substantially exceed half a billion dollars in 1957. Alberta's 1956 share of the total was $356,000,000, and should exceed $400,000,000 in 1957. Saskatchewan's 1956 share was about $33,000,000, and should about double in 1957. The rest of the West shares the balance.

Western Canada's production exceeded 172,000,000 bbl. in 1956 (a 40,000,000 bbl. boost over 1955)—and during 1957 should total somewhere between 213,000,000 and 219,000,000 bbl. Alberta's share in 1956 was 146,000,000 bbl., and should exceed 172,000,000 in 1957. Saskatchewan's share was nearly 20,000,000 bbl., and should nearly double in 1957. Manitoba put out about 5,800,000 bbl., and will show some increase in 1957. British Columbia made a production start —154,000 bbl.—but should about triple yield in 1957, and expand sharply in later years.

The Alberta Treasury's revenue from Crown owned oil and gas rights in calendar year 1956 should total about $130,000,000 — about $21,000,000 more than the former annual record. In 1957 cash bonuses from Crown reserves, together with royalties, fees and rentals on Crown rights, may well bring the provincial treasury about the same as the 1956 record. Payoff to other provinces is comparatively small so far, but is due for rapid expansion, particularly to Saskatchewan.

The oil and gas industry pumped into the western Canadian economy in 1956 a record $700,000,000 in investment in exploration, development, land, pipelines and refineries (up about $200,000,000 over 1955). In the year ahead, total investment should come close to that of 1956.

The impact on world oil supply lines caused by the Middle East crisis boosted western Canadian oil production beyond half a million barrels daily during final quarter of 1956 (average 509,000 bbl. daily) for first time in history. During 1957—due to the Middle East plus normal growth of North American oil hunger—our production will expand from around 560,000 bbl. daily average the first quarter to well over 620,000 bbl. daily in the final 3 months. Alberta's share by year's end will climb to over half a million barrels, while Saskatchewan will pass the 100,000 bbl. daily level.

The long-awaited export of natural gas will start during the final half of 1957, both westward across the Rockies to the Pacific Coast from Peace River, and eastward across the Saskatchewan-Manitoba prairies from southern Alberta, the latter being first stage of export systems into eastern Canada and the U. S. Midwest. Westcoast Transmission's gas line, financed in full and 70 per cent built in 1956, will complete construction and start moving gas to British Columbia and U. S. Northwest markets in the summer of 1957. Trans-Canada Pipelines will probably complete its public financing early in 1957, get out of hock to the Canadian Treasury, complete its Prairie system by the fall of 1957, and probably also start on the eastern phases of what will become the world's longest, costliest gas pipeline system.

Start of gas export from Northeast British Columbia and South-Central-Northern Alberta will bring fairly rapid expansion of gas processing and by-products industries in the West; including the B. C. Peace River and Alberta Pincher Creek projects started in anticipation in 1956, plus others in other Alberta gas fields from which export gas will be drawn.

In 1956 western Canadian oil and gas further cinched its position as Canada's No. 1 mineral producing industry, and the West's No. 2 industry (second only to agriculture). This position will be further strengthened in the year ahead.

In 1956 the industry moved into the ranks of Canada's top half dozen foreign exchange earners, drawing in an estimated $120,000,000 U. S. from export mainly to the United States of over 40 million barrels of crude oil. During 1957 the industry may earn for Canada around one quarter of a billion dollars in foreign exchange, with a near doubling of oil exports, and the beginnings of natural gas export on a large scale.

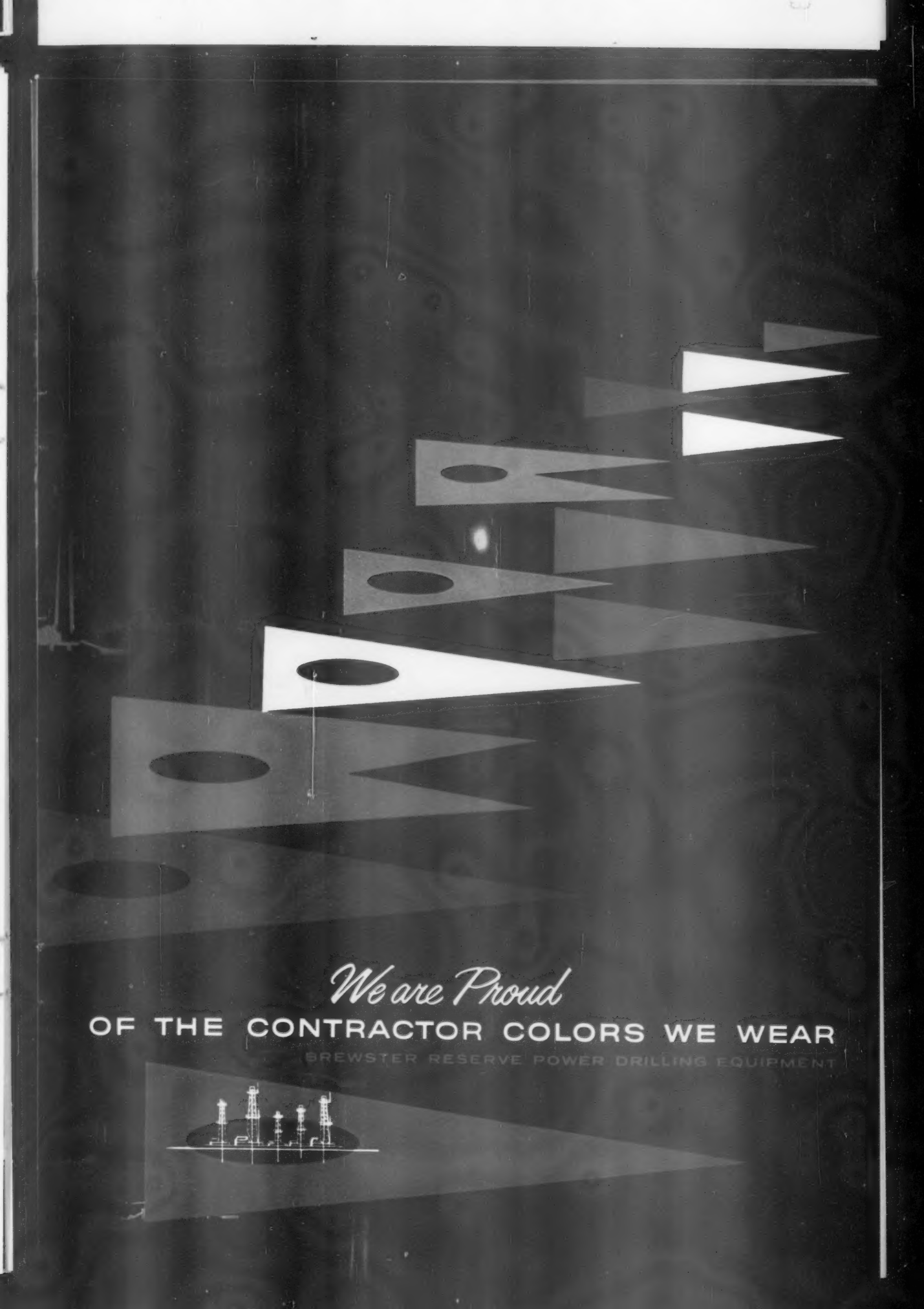
From its springboard of Leduc's discovery a decade ago (when western oil was only an 18 million dollar yearly industry), the boom has carried the industry and the West a long way. But looking to 1957 and beyond, it is obvious that the western Canadian oil and gas industry still has a long way to soar before it reaches full maturity and maximum value to the nation.

PACIFIC COAST

CALIFORNIA

Yorba Linda Field Production Extended

Morey E. Hall successfully completed an extension test located about 1 mile west of regular Yorba Linda field production in Orange County. The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BREWSTER RESERVE POWER DRILLING EQUIPMENT

N-2

A speedy small rig for truck or trailer mounting. Depth — Grassroots to 2,000 feet. Horsepower — 100 to 140.

N-4

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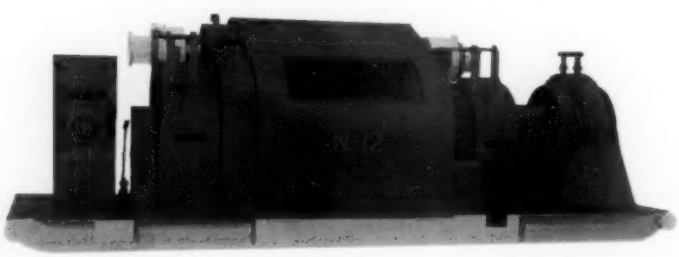
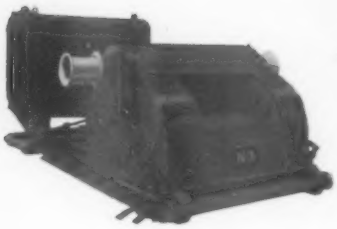
N-12



Engineered from drum to compound to reduce deep drilling costs. Depth — 10,000 feet on down. Horsepower — 1,200 to 1,500.

N-95

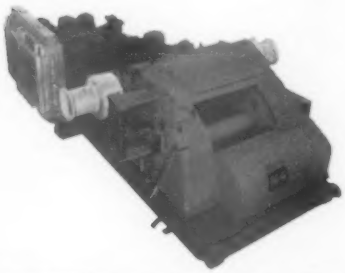


N-3

Portable and easy to operate on shallow drilling or deep servicing. Depth — to 3,500 feet. Horsepower — 140 to 160.

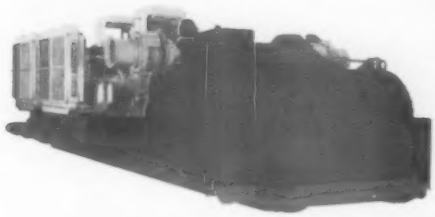
N-45

Highly portable shallow to medium depth rig in torque converter or mechanical model. Depth — to 6,500 feet. Horsepower — 450.



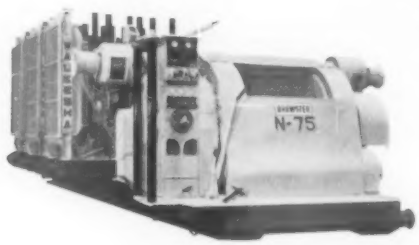
A tough light rig for fast drilling. Depth — 4,500 to 5,500 feet. Horsepower — 200 and 350.

N-55



Medium depth rig. The favorite of drillers from the Gulf Coast to Canada. Depth — 5,000 to 8,000 feet. Horsepower — 525 to 600.

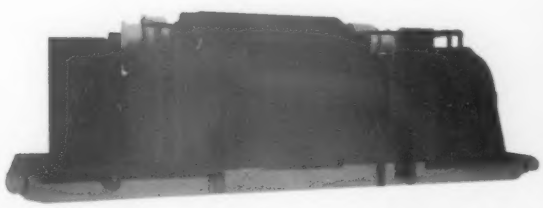
BREWSTER EQUIPMENT



N-75

Fast, easy to move drawworks in the medium to deep drilling class. Depth — 10,000 feet. Horsepower — 600 to 750.

Compact for economical moves — Reserve powered for deep drilling. Depth — 8,000 to 14,000 feet. Horsepower — 1,000 to 1,200.



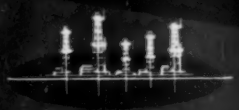
N-85

850 horsepower for faster drilling of medium to deep wells. Side-skidded — moves in three over-the-road packages.

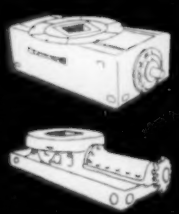
BREWSTER

MATCHED EQUIPMENT

A fine drawworks will work faster and more economically if it is used in conjunction with matched travelling and rotating equipment. Since 1910 Brewster has worked to build this balanced efficient drilling team. As drawworks have improved and become faster Brewster blocks and rotary tables have kept pace. Today there is a matched auxillary equipment team of equal strength and speed for every Brewster Drawworks.



THE BREWSTER COMPANY, INC.
Shreveport, Louisiana



OILBATH ROTARY TABLES

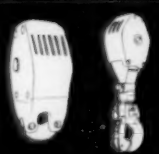
RSH-27 1/2 (N-12) **RSH-22** (N-95) **RSH-18** (N-75, N-55 and N-45)

OB-18 (N-4) **OB-12-L** (N-3) **OB-12-S** (N-2)

OILBATH SWIVELS

8-SX N-12 and N-95 **6-SX** (N-75) **4-SX** (N-55, N-45 and N-4)

3-S (N-3 and N-2)



TRAVELING AND HOOK BLOCKS

500 TON (N-12) **300 TON** (N-95) **200 TON** (N-75) **120 TON** (N-55)

HT-100 (N-45, N-4 and N-3) **HT-50** (N-2)

CROWN BLOCKS

500 TONS **300 TONS** **250 TONS**

200 TONS **150 TONS** **100 TONS**

SUPPLY HOUSES

Howard Supply Company — Apex Equipment Company
Bovaird Supply Company — Industrial Supply Company
Murray Brooks, Inc. — United Supply and Manufacturing Company
For Canada, Mexico and Export Sales, The Brewster Company

OTHER BREWSTER PRODUCTS REELS AND WINCHES CHRISTMAS TREES PUMP DRIVES
WELL HEADS TUBING HEADS CASING HEADS

well, 1 Community, started flowing through casing from the perforated interval 2,372-2,500 ft. at a rate of 928 bbl. daily of 15.3°-gravity crude. This well is in NE NE 20-3s-9w.

Monterey Moves Offshore Platform

Monterey Oil Co. set conductor pipe on its second lease evaluation core hole being drilled from a drilling platform on State Lease 1550 off Huntington Beach. This second hole is being drilled almost ¾ of a mile north of the first core hole which was abandoned at 8,986 ft. Monterey is coring to find a suitable place to build an artificial drilling island to develop the 2-sq.-mile lease located 1 mile offshore.

New Pool Looms For Bandini Field

General Exploration Co. was apparently nearing a new deeper pool discovery with a well on the east edge of the Bandini field activity in East Los Angeles. The well, 24 CWOD, has been plugged back from 9,484 ft. to 8,560 ft. in an attempt to get a completion in two intervals between 8,329 and 8,560 ft. If the well is completed, it will give this field, located in the light industrial district east of downtown Los Angeles, its third new pool discovery last year.

Union Misses With Stevens Offset

Union Oil Co. of California missed on an extension test just two locations west of its Stevens sand discovery scored in May 1956, about 1 mile northwest of regular Strand field production in Kern County. Union quit the dry hole after running electric logs at 10,260 and 12,538 ft. Total depth was 12,665 ft.

BASIN AND RANGE

NEVADA

Deepen Job Due for Clark County Wildcat

U. S. Oil Co. was rigging a rotary to deepen 1X Wilson to 4,500 ft. This wildcat, located 14 miles southwest of Las Vegas in Clark County, has been idle for some time at 2,026 ft.

Joe W. Brown was drilling below 7,000 ft. on 1 Wilson 5 miles south of Las Vegas while Richfield Oil Corp. was preparing to core below 2,361 ft. on 1 Scott in the Bull Run basin area of Elko County in northern Nevada.

ROCKY MOUNTAIN

WASHINGTON

Shell Oil Co. has staked a location for a 4,500-5,500 ft. no dope stratigraphic hole in SE NE 10-16n-1w in the Tenino area of Thurston County. This is about 14 miles southeast of the state capital at Olympia.

MONTANA

Sheridan County Strike Shut In

Amerada Petroleum Corp. shut in the 1 Tange Silurian discovery in northeastern Montana's Sheridan County. The Outlook area wildcat, located in C NE SE 20-36n-53e, flowed oil at the daily rate of 2,742 bbl. on ½-in. choke from Silurian perforations at 9,056-74 ft. The discovery opened first production in the county and in this corner of the state.

Location was announced for the 1 Loucks, C NE SW 35-36n-52e, 4 miles southwest of the 1 Tange. This well will go to the Silurian at 9,000 ft.

Operator Sets Casing at Melstone Discovery

Casing was set at Lawrence Barker, Jr. 1 Hougen et al, NW SW NW 22-10n-29e, indicated Musselshell County discovery. The wildcat, 2 miles west of Melstonefield and 12 miles northeast of Texota Oil Co. 1 Goffena, recovered 2,700 ft. of oil on a drill-stem test at 4,229-53 ft.

Dakota Gas Discovery Tested in Yellowstone

Lion Oil Co. 1 Hereford, SW NE NW 1-1n-28e, Yellowstone County Dakota gas discovery, flowed gas on calculated open flow at the rate of 10,800 M.c.f. per day. Perforations are at 2,596-2,604 and 2,610-28 ft. in the Dakota. Nitrogen content of the gas is 58 per cent; 41 per cent methane. Location is 15 miles northeast of Billings.

COLORADO

Oil Discovery Shut In Near Craig

Malco Refineries 1 Kowach, Moffat County oil discovery in C NW NW 25-6n-90w, was shut in after the operator swabbed oil at the rate of 12½ bbl. per hour from perforations at 9,353-60 ft. in the Sinarump. Location is 4 miles south of Craig. The 2 Kowach is under way in C SE NW 25-6n-90w.

Gas Discovery Finaled In Rio Blanco County

Rio Blanco County has a new gas pool. F. A. Thurman 1 Government, NE SW NE 16-4s-97w, 10½ miles southwest of South Piceance field,

REPORTS OF PERFORMANCE

from users during the past 16 years show that Kennametal* lasts 20 times longer than steel and 3 to 5 times longer than special and super alloys.

• A Texas producer reported sand abrasion forced a pulling job every 14 to 20 days. After 448 days on the job, Kennametal Balls and Seats showed no wear when well was pulled for other than valve job.

INDUSTRY AND KENNAMETAL ...Partners in Progress

Kennametal API Balls and Seats are available at repair shops of most major pump manufacturers. Ask your service man to standardize on them. They'll cost you less in the long run. KENNAMETAL INC., Latrobe, Pennsylvania.

*Kennametal is the Registered Trademark of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum.

D-5960

flowed 2,000 M.c.f. of gas per day from perforations at 5,924-42 and 5,792-5,904 ft.

NORTH DAKOTA

Operator Coring Ahead At Billings Discovery

Northern Pump is coring below 9,000 ft. at the 1 Fritz apparent Heath discovery in SE SE 15-137n-100w, Billings County. This indicated discovery flowed at the estimated rate of 25 bbl. per hour on drill-stem test in the Heath at 8,043-81 ft. Nearest oil is at Fryburg field, 12½ miles north. Craig is now in the Charles-Mississippian.

Spearfish Prospect Perforated

Leach Oil Co. perforated the 1 Smith, SW SW 14-162n-80w, Bottineau County Spearfish - Triassic discovery prospect, at 3,425-33 ft. and is swabbing load oil.

A drill-stem test in the Spearfish at 3,425-30 ft. recovered 1,700 ft. of gas in the pipe, 35 ft. slightly oil-cut mud and 350 ft. of gassy oil.

This indicated discovery is located 4 miles south of Westhope town and 9 miles southeast of Kuroki field.

More Oil Shows Reported At Deep Beaver Lodge Well

Amerada Petroleum Corp. reported recovery of more oil shows in cores at 1 Iverson-Nelson in NW SE NW 2-155n-96w, Williams County. The cores were at 12,289-12,477 ft.

This deep test is slated for the Winnipeg at 13,500 ft. The well is inside Beaver Lodge, Madison granddaddy of Williston basin production in North Dakota. Gas flowed at 3,000 M.c.f. per day on a test at 11,187-11,574 ft., plus 5 bbl. of oil and 8 bbl. mud in 35 minutes on a recent drill-stem test. Coring is now progressing below 12,734 ft.

WESTERN NEBRASKA

Pipe Set at Kimball County Confirmation

Pipe was landed at 7,019 ft. at R. W. McDowell, Jr. 1 Lightbody "A," C NE NW 26-13n-57w, Kimball County. This well is an offset to a recent discovery at McDowell and Sunray 1 Lightbody in C SW NE 26-13n-57w. The discovery well pumped 27 bbl. of oil in 12 hours with a trace of water.

A drill-stem test at the "A" well got 5,835 ft. of free oil at 6,936-7,035 ft.

Rank Wildcat Staked In Lincoln County

V. M. Mann has staked a rank wildcat on the extreme east side of the Denver basin in Lincoln County. The 1 Chamberlin, NE NE NE 14-11n-32w, 8 miles north of Dickens, is in an area of no previous drilling within 14 miles.

SOUTHEASTERN STATES

FLORIDA

Escambia County Test Given Up as Failure

Zach Brooks and associates are quitting their deep wildcat test 5 miles southwest of Pensacola, at the southwestern tip of Florida's panhandle, in Escambia County.

The test, near the Alabama line and a short distance inland from the Gulf of Mexico, was drilled to 12,515 ft. No shows of oil or gas were reported.

Spot location is in 31-2s-31w, on the operators' Caldwell-Garvin Unit. It is far-removed from nearest other test.

In the meantime, in St. Lucie County, the southeastern coastal sector of the state, Amerada Petroleum Corp. has been unable to regain circulation in its deep test, and will attempt to resume drilling by use of air instead of mud. The test, 1 Cowles, in 19-36s-40e, lost circulation while drilling at 5,195 ft. Drilling is set up to go at least to 10,000 ft.

ARK-LA-TEX

ARKANSAS

Mitchell Oil Found At Gin City Test

David Crow, Trustee 1 Roger G. Walcott et al, C NE SE 17-19s-25w, ⅞ mile southeast of Gin City, Lafayette County, southwestern Arkansas, found oil on core of the Mitchell sand at 5,807½-11½ ft. and is now coring in the Sligo. A drill-stem test was run at 5,808-11 ft. with recovery of 120 ft. gas-cut mud and 1 pint of free oil reported.

Pettet Production Assured at Pace City

Jones-O'Brien, Inc. are assured production in the Pettet on basis of drill-stem test run at 3,056-82 ft. at the 1 Pace et al, NE NE 25-15s-18w, Pace City field outpost well in Ouachita County. A drill-stem test at 3,056-82 ft. recovered 170 ft. oil and 240 ft. of gas-mud-cut oil. Operator is running casing.

Successful Wildcats

NORTH TEXAS

Cooke County: Kay Kimbell 1 Lynch heirs, J. M. Stephens Sur., A-1441, 3 miles S Callisburg. IPP 62 BOPD, 44°, GOR 100, perf. 2,714-15 ft. TD 4,790 ft.

Knox County: Frierson Co. 1 Gaither, 133-45-H&TC, 1 mile SW Munday. IPP 44 BOPD, 36°, perf. 1,981-90 ft. TD 2,150 ft.

J. L. Stodghill and Hayden Farmer 1 Beck, Blk. 100, D&W Sur., 4 miles N Munday. IPP 35 BOPD, 38°, perf. 2,030-36 ft. TD 3,152 ft.

Wichita County: Dublin-Kiel 1 W. T. Waggoner "Xmas," S. Holloway Sur., A-533, ¾ mile SW Electra. IPP 25 BOPD, 38°, GOR 200, pay 1,814-34 ft. TD 2,250 ft.

Wise County: Carter-Jones Drilling Co. 1 Stone, G. R. Comstock Sur., A-1062, 3 miles W Chico. IP 148 BOPD, ⅜-in., TP 150 psi., GOR 700, 36°, perf. 5,331-46 ft. TD 5,780 ft.

Jack Grace Production Co. 1 Brannan, W. Watson Sur., A-870, 5 miles NW Chico. IP 186 bbl. in 8 hours, 30/64-in., TP 120 psi., 42°, GOR 700, perf. 5,776-91 ft. TD 5,853 ft. Suggested name, Chico, W, 5,800-ft. Conglomerate.

Young County: Kenneth J. Rich 1 Matthews, J. Heighton Sur., A-2162, 5 miles NE Graham. IP 150 BOPD, 32/64-in., TP 80 psi., 41°, GOR 470, perf. 3,620-30 ft. TD 3,631 ft.

Stephens Oil & Gas Corp. 2 Fannie Young, TE&L Sur. 1116, 2¼ miles NE Eliasville. IP 125 BOPD, 12/64-in., TP 150 psi., 42°, GOR 296, pay 4,265 ft. TD 4,310 ft.

EAST TEXAS

Wood County: Shell Oil Co. 1 Stella Wright, E. Goodsir Sur., A-254, 4 miles NW Quitman, new pay in Quitman field. IP 106.7 BOPD, ¼-in., TP 220 psi., 42°, GOR 1050, Rodessa perf. 8,548-54 ft. TD 14,500 ft.

WYOMING

Niobrara County: National Cooperative Refinery Association 1 NCRA Unit, NW NE NE 2-39n-61w. Swabbed 50 BO in 12 hours. Mule Creek dolomite discoverer, new pay. TD 2,829 ft. Pahasapa.

COLORADO

Rio Blanco County: F. A. Thurman 1 Government, NE SW NE 16-4s-97w. IP 2,000 M.c.f. of gas per day, Cretaceous discovery, new field. TD 6,017 ft.

NEW MEXICO

San Juan County: C. M. & W. Drilling Co. 1 Elliott, C NW NE 30-26n-13w. IPP 77 BOPD, Gallup discovery, new field. TD 5,400 ft. Lower Gallup.

UTAH

Uintah County: Havenstrite Oil Co. 72-22B Federal Unit, SW NE NE 22-9s-20e. IPP 587 BOPD and 13 bbl. salt water. Green River discovery, new field. TD 3,610 ft. Green River.

NORTH DAKOTA

Bottineau County: North Central Oil Co. 1 Pearson, NW NW 36-163n-83w. IPP 196 BOPD, Mission Canyon discovery, new field. TD 4,021 ft. Mission Canyon.

PENNSYLVANIA

Indiana County, Young Township: T. W. Phillips Gas & Oil Co. 3 Fee (Neal surface) 2,595,000 cu. ft., gas after fracture. Tully 6,850 ft., Onondaga 7,398 ft., chert 7,415 ft., gas 7,424-47 ft. TD 7,585 ft.

Offshore game blue-chip affair . . .

. . . Almen Holds a Winning Hand

A FORMER office boy who matured fast with his company is playing Sinclair Oil & Gas Co.'s hand in the offshore game—the biggest blue-chip poker affair in the oil business.

He is G. D. (Dan) Almen, Jr., director of Sinclair's offshore operations in the Gulf of Mexico. Almen recently was promoted to a company vice presidency at the age of 38.

The move in all probability reflects two reactions by Sinclair management: Pleasure at the showing made since 1954 by Almen and his men and belief in the growing importance to Sinclair of its offshore investment.

Ticklish job . . . Almen has been on a hot seat ever since he was sent to New Orleans from Tulsa early in 1954 to manage the offshore operating division.

He represents not only Sinclair management but the management of three other companies who joined Sinclair in the offshore ventures. Sinclair is operator for the partnership which also includes El Paso Natural Gas Co., Sohio Petroleum Co., and Peoples Production Co., a subsidiary of Peoples Gas Light & Coke Co., Chicago.

The group has put together in excess of 37,000 acres off Louisiana and scattered leases off the Texas coast near the Sabine River. Almen's division currently is developing two very promising leases, both in very deep water and one 43 miles from shore.

Payoff may be near . . . Almen's division moved fast when it jumped into the offshore venture. And it may be far luckier than many others who went offshore, because the group has prospects of good production and a return on its investment early in the game.

These two prospective fields are:

. . . Block 175, Eugene Island. The discovery well on this lease is in 87 ft. of water, 40 miles from land, but 75 miles from nearest land base at Morgan City. Location also is 12 miles from nearest production.

The discovery was drilled to 13,004 ft. with the productive zone a Miocene sand at 11,830-38 ft. Initial production averaged 417 bbl. of 37°-gravity oil through ⅛-in. choke. Pressure was 4,400 psi. The well currently is shut in while four other wells are drilled from the same permanent, self-contained platform.

. . . Timbalier Bay area. Discovery well here was on State Lease 2490, Block 15 off Lafourche Parish in 92 ft. of water. Initial flow averaged 138 bbl. of 55.2°-gravity condensate with 1,680,000 cu. ft. of gas per day on ¼-in. choke. Pressure was 4,300 psi. The well was drilled 13,756 ft. with production from Miocene perforated at 11,986-96 ft.

Like the Eugene Island well, production is shut in while seven other wells are drilled from the same platform. When drilling is completed, the wells will be produced.

Only last week another discovery was made in Block 86 of South Timbalier area where the Sinclair group holds a 5,000-acre federal lease. On a 9-hour test the wildcat flowed at the rate of 336 bbl. of 35.8°-gravity oil daily through a 12/64-in. choke. Perforations were in the Miocene sand at 12,167-85 ft.

Blue-chip poker . . . Operating offshore is like playing in a high-stake poker game, Almen says. The chips are expensive but so are the pots.

Besides working in a region credited with the largest known undeveloped domestic oil reserves, oil companies offshore have a little more favorable allowable picture. Almen says Louisiana uses a depth-bracket system in setting allowables offshore. This means that wells offshore are allowed to produce 1½ to 1⅔ more oil than a similar well onshore because of the extra costs involved.

Almen is a trained lawyer but got his start with Sinclair as an office boy the summer he was graduated from Tulsa Central High School. He worked as a receptionist at Sinclair headquarters for two summers and as mail clerk one summer while attending the University of Oklahoma. Before he got his bachelor of arts and law degrees, however, he also worked three summers as roughneck for a drilling company in the Oklahoma oil fields near Wewoka.

But before he could return to Sinclair for a permanent job in February 1946, Almen spent nearly 4 years in military service. He was discharged as a field artillery captain. In Sinclair's legal department, Almen handled conservation matters for the company in several states and did general court work. He was transferred to the executive department as assistant to the president in 1953. The following year he moved to New Orleans as division manager.

Berndt K. Lyckberg, manager of chemical laboratories for Firestone Plastics Co. in Pottstown, Pa., has joined W. R. Grace & Co. as general manager of the company's new Baton Rouge, La., plant. Lyckberg was with Standard Oil Co. (Ind.), before joining Firestone.

Ralph W. Garrett, counsel for Sinclair Oil & Gas Co. and Sinclair Crude Oil Co., Tulsa, has retired. Garrett joined Sinclair's legal staff in 1916. He has been counsel and a director of the company since 1948. He will remain with the company as a consultant. Garrett will be succeeded by **Angus A. Davidson,** formerly counsel and coordinator of legal, tax, and right-of-way for Sinclair Pipe Line Co., Independence, Kans.

Personals

E. Earl Read, general superintendent of Mid-Valley Pipeline Co., Longview, Tex., since 1955, has been appointed vice president in charge of operations for the company. Read joined Sun Oil Co. as a pipeliner in 1926 and was promoted to chief clerk of Sun-Yount Lee Pipe Line Co. in the East Texas division in 1931. In 1935 he was made superintendent of East Texas field and later transferred to Beaumont, Tex., and promoted to operating superintendent of all East Texas pipelines. He came to Mid-Valley as senior superintendent in 1950 when the company was formed. He was named general superintendent in 1955.

John T. Barton, assistant superintendent in the ethylene dichloride department of Dow Chemical Co.'s Texas division plants, Freeport, Tex., has been promoted to superintendent.

John H. Emerson, III, engineer in charge of the Texas City line for Coastal States Gas Producing Co. in Texas City, Tex., has been appointed assistant to the chief engineer in Corpus Christi, Tex.

Henry L. Waszkowski, assistant to the coordinator of domestic production for Socony Mobil Oil Co., Inc., has been appointed assistant to the manager of the producing department. Waszkowski has been with Socony and its affiliates since 1939.

Ira Harmon, district foreman at Medina, Ohio, for Ohio Fuel Gas Co., has been promoted to eastern district production superintendent succeeding **Frank King,** who has retired. **H. L. Brammer,** construction foreman at Medina, will succeed Harmon there.

W. E. Schultz, mechanical engineer for Shell Oil Co. in Midland, Tex., has been transferred to the company's production technical services department in Houston. **S. T. Serocki** and **R. J. Woodward,** exploitation engineers in Houston, have been transferred to Hobbs, N. M., and Midland, Tex., respectively. **J. L. Ward,** junior exploitation engineer in Hobbs, has been transferred to Midland. **C. S. Sargent,** and **L. C. White,** junior exploitation engineers in Midland, have been transferred to the Denver area.

Earl Kirk, Jr., staff engineer in the gas division of Sunray Mid-Continent Oil Co., has been transferred to Benton, La., from Snyder, Tex.

E. A. Swedenborg, district petroleum engineer for the U. S. Geological Survey at Casper, Wyo., has retired and will open consulting offices in Casper. Swedenborg has been with USGS since 1926.

Bruce E. Roll, production superintendent of the Bismarck, N. D., district of Lion Oil Co., a division of Monsanto Chemical Co., has been appointed production superintendent of the Kansas production district and transferred to Pratt, Kans. Roll has been with Lion since 1951.

Paul E. Carlton has been appointed district geologist in Tidewater Oil Co.'s new Durango, Colo., office. Carlton was formerly in the company's Tulsa office. **Homer E. Oliver,** geologist, and **Joe Malloy,** landman, will also have headquarters in Durango.

F. F. Meissner, junior geologist with Shell Oil Co.'s exploration technical services department, Cheyenne, Wyo., has been transferred to Roswell, N. M. **F. J. Sauer,** also junior geologist in Cheyenne, has been transferred to Abilene, Tex.

E. E. Ives, assistant division superintendent of Cities Service Oil Co.'s Oklahoma City, Seminole and Ponca City, Okla., districts, has been named division superintendent of production for the North Oklahoma area. **Hugh L. Riley,** assistant division superintendent for the company's North Texas-South Oklahoma area, has been appointed division superintendent of production for that area.

Robert E. Rettger, coordinator of geophysics for Sun Oil Co., has been elected 1957 president of the Dallas Geophysical Society. Other officers are **Chester J. Donnally,** first vice president, Donnally Geophysical Co.; **Albert W. Musgrave,** second vice president, Magnolia Petroleum Co.; and **William C. Woolley,** secretary-treasurer, Magnolia Petroleum Co.

J. Patrick D'Artois, representative for Conorada Petroleum Corp. in Guatemala, has been appointed manager of operations of Ohio Oil Co. of Guatemala, subsidiary of Ohio Oil Co. **A. H. Petsch,** formerly district geologist at Amarillo, Tex., for Ohio Oil, has been named exploration manager for Ohio Oil of Guatemala. Petsch has been on assignment with Conorada since 1955.

Donald F. Beard has been appointed senior buyer for natural gas in Dow Chemical Co.'s Texas division. Beard joined Dow in 1955 as production development engineer.

S. A. Krajicek, assistant chief engineer at the Casper, Wyo., refinery of Standard Oil Co. (Ind.), has retired after 35 years with the company.

Howard F. Gannon, district manager at Forest City, Iowa, for Peoples Natural Gas, division of Northern Natural Gas Co., has been named district manager at Manchester, Iowa. **Edward A. Meehan,** local superintendent for the company at Madrid, Iowa, will succeed Gannon as district manager at Forest City.

Max M. Fisher, executive vice president and secretary of Aurora Gasoline Co., has been elected chairman of the board. Fisher succeeds **Henry E. Wenger,** who has resigned. Wenger will remain a director, chairman of the executive committee, and becomes secretary of the company.

Herbert K. Miller, division dispatcher for Northern Natural Gas Co. at Midland, Tex., has been promoted to pipeline district foreman at Burdett, Kans. **John R. Pease,** crew foreman for the company at Paulina, Iowa, has been promoted to district foreman of the new South Dakota pipeline district.

Hobart G. Mariner, general manager of Service Pipe Line Co., has been elected a director. Mariner joined Service Pipe Line in 1940. He was manager of the Missouri division until 1954 when he supervised construction of the company's crude line from Fort Laramie, Wyo., to Freeman, Mo. He was appointed general manager in 1955.

William C. Morrow has been appointed assistant regional engineer for Atlantic Refining Co. and transferred from Philadelphia to Reading, Pa. **Richard Conklin** has been named area engineer in the company's Philadelphia refinery. **Samuel Hall, James McMonagle,** and **Stanley Morris** have been named planning engineers in the refinery. **Frederick Snyder** has been appointed assistant development engineer at the refinery, and **John Klopp** will serve in the same capacity in the Philadelphia research and development department.

Personals

Murray E. Body has resigned as executive vice president and director of Ne-Tex Oil Corp., Abilene, Tex., oil producing firm.

J. F. Sauer, division gas superintendent for Pacific Gas & Electric Co., retired January 1 after 44 years with the California utility. He will be succeeded by **H. A. Danielson.**

William V. O'Connor, California's chief deputy state attorney general, has been appointed head of a special legal division of the attorney general's office which will handle tidelands disputes.

H. V. Anderson, assistant division superintendent in Liberal, Kans., for Cities Service Oil Co., has been appointed division superintendent. Anderson has been with Cities Service since 1933. He was district superintendent in Liberal before becoming assistant division superintendent in 1953.

George F. Hornaday has been named associate manager of research and development for Houdry Process Corp. He succeeds **T. A. Burtis,** now president and chairman of the board. Hornaday was formerly assistant manager of process sales. **D. Eugene Norris** will replace Hornaday in this position.

Charles E. Williams, United Natural Gas Co.'s superintendent of compressor stations, gasoline plants, gas dispatching and communications, has been appointed general superintendent of operations in addition to his other duties. **Harry A. Goodman,** assistant superintendent of distribution for the company, has been named superintendent.

R. B. STEWART

R. B. Stewart, assistant manager of Phillips Petroleum Co.'s natural-gas department, has been appointed manager. He succeeds A. M. Rippel, who was killed December 12 in a company plane crash. **Dan L. Mayer,** general superintendent of the natural-gas department, will replace Stewart as assistant manager. **M. H. Cullender,** gas sales representative for the company in Amarillo, Tex., has been appointed director of the department's engineering division, a combination of the former mechanical-engineering and production-engineering divisions. **C. T. Dickerson,** formerly director of gas-settlements division, will head the new services division. **W. L. Cox** has succeeded Cullender in Amarillo.

C. L. Parkhill, Jr., has been named executive vice president of California Western Gas Co., San Francisco.

R. P. WHITE

Robert P. White has been appointed vice president in charge of the pipe-coating division of H. C. Price Co. White has been manager of this division since 1951. He joined Price in 1940. In his new position White succeeds **J. Stewart Dewar,** who has retired.

Charles C. Booth, geologist with Atlantic Refining Co., has been transferred to Corpus Christi, Tex., from Dallas. **John A. Hawkinson,** geologist in Dallas, has been transferred to Midland, Tex. **Joseph H. Faulk** has been appointed development drilling engineer in the company's Dallas office, and **James C. Osborne** has been named mechanical engineer there. In other Atlantic appointments, **Tom R. Sedberry** has been promoted to district engineer in Houston. **Willis N. Keisling** is regional engineer in Midland, Tex., and **Stanley H. Christianson,** reservoir engineer there.

A. P. Coe has been named district superintendent of Cities Service Oil Co.'s new North Odessa, Tex., district.

Robert A. Harris and **Charles N. Carmack,** Tulsa independents, have formed a new exploration and production firm, Harris-Carmack Oil Corp., Tulsa. Harris is president and Carmack vice president of the company.

Charles Stamos has resigned as senior petroleum engineer and examiner for the Texas Railroad Commission at Austin, Tex., to join Tennessee Gas Transmission Co. at Houston as engineer in the gas-reserves section.

F. C. Loomis, O. N. Miller, J. E. Toussaint, and **H. G. Vesper** have been named vice presidents and directors of Standard Oil Co. of California, Western Operations, Inc. Loomis is vice president in charge of supply and transportation, Miller, in charge of manufacturing; Toussaint, producing; and Vesper, marketing. Toussaint and Vesper have previously served as vice presidents of the parent company, Standard Oil Co. of California.

DEATHS

Wiley L. Moore, 68, former president of Wofford Oil Co. and of United States Oil Co., died December 30 in Washington, D. C. after a heart attack. Moore was chairman of the board of Moore, Inc., and had served as president of Pure Oil Co. of the Carolinas and Pure Oil Co. of Tennessee. One of his most recent activities was proposal in 1954 of a 1,800-mile crude and products system from Wyoming to Arizona, New Mexico, and Texas. Moore was instrumental in the construction of one of the first big products lines, Southeastern Pipe Line Co., Inc.'s carrier from Chattanooga, Tenn., to Fort St. Joe, Fla. Moore also was a promoter of Oil Basin pipeline from Billings to Glendive, Mont.

Robert W. Haiges, 56, geologist with Phillips Petroleum Co. in Bartlesville, Okla., died December 27 in Tulsa of a brain tumor. Haiges had been with Phillips 30 years.

John F. Conway, 62, publicity director of Sinclair Oil Corp., died December 30 in New York after a brief illness. Conway joined Sinclair's advertising department in 1923. He was a member of the American Petroleum Institute and the Association of Petroleum Writers.

F. A. Nelson, 46, Midland, Tex., independent most recently associated with Lee Durrell in oil exploration, died December 25 in Midland. Nelson earlier spent 11 years with Phillips Petroleum Co.'s production department, then joined American Trading & Production Corp. at Midland. He helped form Shirley Millder Drilling Co., which was dissolved in 1955.

Chester M. Overocker, 60, district production foreman for Shell Oil Co. in Bakersfield, Calif., died December 25 in Bakersfield.

Frank Aldrich, 59, Midland, Tex., consulting geologist and independent, died December 29 in Midland.

Samuel H. Malarkey, 86, Cleveland, Okla., retired drilling contractor and independent operator, died December 31 in Tulsa.

Merle P. Long, 67, Ponca City, Okla., an executor of the Lew Wentz estate, died January 1 in Menlo Park, Calif.

Latest Figures . . . Industry Trends

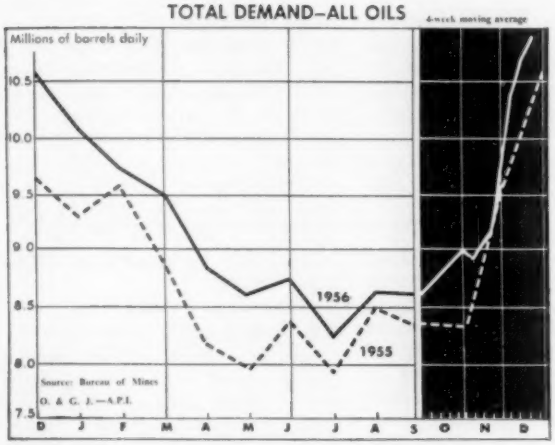
A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,318,225	UP	24,440	UP	137,688
Crude stocks	269,909,000	DOWN	3,798,000	UP	8,973,000
Completions	1,141	UP	70	DOWN	59
Refinery runs*	8,061,000	UP	61,000	UP	223,000
Gasoline stocks*	180,543,000	UP	3,506,000	UP	18,802,000
Kerosine stocks*	32,029,000	DOWN	389,000	UP	3,251,000
Distillate stocks*	134,980,000	DOWN	4,630,000	UP	17,026,000
Residual stocks*	42,577,000	DOWN	568,000	UP	3,077,000
Four-product stocks*	390,129,000	DOWN	2,081,000	UP	42,156,000
Total imports*	1,309,700	UP	83,200	DOWN	249,100

*For week ended December 21.

ALL TABLES AND CHARTS BASED ON A.P.I. REPORT ARE FOR WEEK ENDED DECEMBER 21 SINCE THE A.P.I. REPORT FOR DECEMBER 28 WAS DELAYED BY END-OF-YEAR HOLIDAYS.

TOTAL DEMAND—ALL OILS



The New Year Starts With Some Markets Strong; Others Weak

MARKET trends were mixed at the opening of the new year. The following tabulation gives some of these variations.

. . . **Demand for crude** is very strong at Gulf Coast loading ports, but interest in inland crudes is limited by pipeline capacity to move these crudes to the coast. Some extra Rocky Mountain crude is being produced for export. Movement is by pipeline to the Mississippi River and then by barge to the Gulf Coast.

Export demand for crude has produced a crop of rumors of probable price increases for crude. Some of the predictions include an across-the-board boost in contrast with recent adjustments that have recognized the demand for heavy crudes to cover demand for residual fuel.

. . . **European demand** for residual has raised prices quoted for this product on the Gulf Coast. These higher quotations have tended to raise prices in the Mid-Continent since some Group 3 material is moving by tank car to the Gulf Coast. The draining of any Group 3 surplus caused firm prices. Actual demand for heavy fuel in the North Central states has not been up as much as some suppliers expected. The lack of increase may have been due to the good supply of natural gas.

High prices offered for residual on the Gulf Coast is creating an unbalanced situation in normal Gulf-East Coast markets. The Group 3 resid moving to the Gulf Coast starts with a refinery price of at least $2.30 a barrel. Transportation to the Gulf Coast amounts to about $0.72 a barrel or $3.02 before terminal charges on the coast. This cost is very near the normal price of $3.05 for barge delivery in New York Harbor. Any spot material costing better than $3.00 a barrel on the Gulf Coast can't be delivered to industrial consumers in New York in competition with coal.

. . . **Residual-fuel supplies** are short on the West Coast. A. C. Rubel, president of Union Oil Co. of California, estimated that it would take an increase of 20-30 cents a barrel to bring the needed shift in yields from light products to residual.

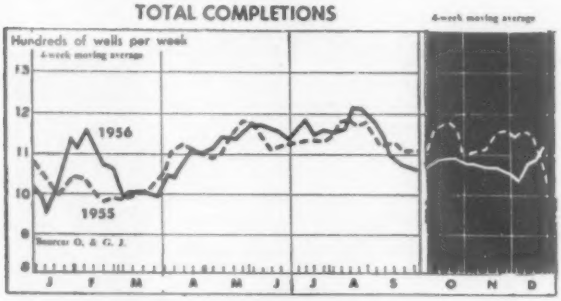
Part of the West Coast shortage has been due to the higher percentage of light crude processed since the opening of refineries in Washington operating on Canadian crude.

. . . **Gasoline stocks** are much too high. Gasoline shipments to Europe have been limited to relatively small quantities of low-octane gasoline from the Gulf Coast.

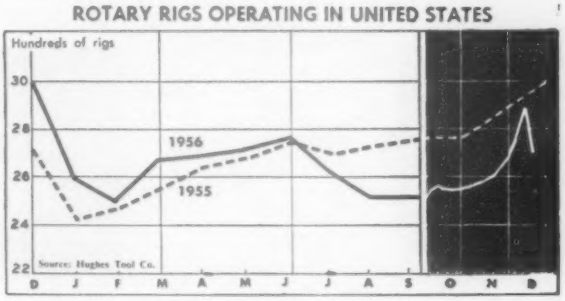
Unless there is a definite shift in refinery yields, pressure from surplus inventories will keep spot gasoline prices down. If spot gasoline prices continue to slide, tank-wagon prices must follow. There is no definite spread existing between spot refinery prices and tank-wagon prices. But, if the difference becomes too great, the branded marketer loses more and more of his business to sellers of unbranded material. If the shift passes the breaking point, the branded marketer lowers tank-wagon prices.

. . . **Stocks of L.P.G.** were very high at the end of the year. Unless the remainder of the winter is very cold, there will not be as much vacant cavern space to be filled next summer as in 1956.

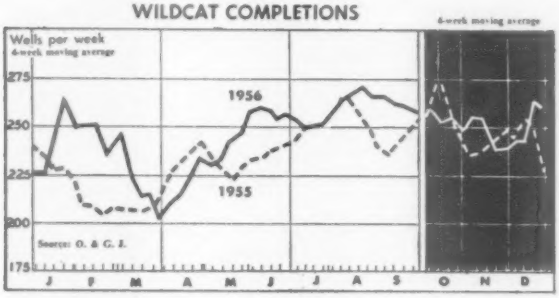
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	12-24-56	12-17-56	12-26-55
North Central and East	112	136	131
Southeast	34	42	35
Okla., Kans., Ark., Mo.	471	511	493
Louisiana	473	501	468
North and East Texas-Panhandle	435	478	431
Gulf and South Texas	297	290	280
West Texas-New Mexico	524	566	624
Rocky Mountain	238	256	279
Pacific Coast	112	114	143
Total United States	2,696	2,894	2,884
Western Canada	234	238	200

*Hughes Tool Co.

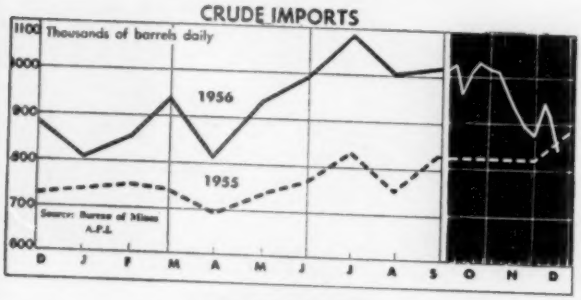
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 29, 1956

	Total of all wells							Wildcat completions and discoveries									
						Cum.							Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	107	73	0	0	0	0	0	0	0	1	49	50
Arkansas	32	16	0	16	102,167	*1,002	804	0	0	0	9	9	33	0	8	149	190
California	40	19	0	21	168,100	2,243	2,464	0	0	0	0	0	49	0	9	448	506
Colorado	26	2	3	21	119,367	*1,222	1,537	0	0	0	14	14	26	0	20	629	675
Illinois	70	24	1	45	159,344	*3,808	3,892	2	0	0	16	18	51	0	5	716	772
Indiana	22	10	1	11	31,415	*741	706	0	0	0	2	2	16	0	1	128	145
Kansas	101	41	9	51	338,231	*4,941	4,958	2	0	1	16	19	125	4	47	897	1,073
Kentucky	46	20	5	21	61,161	*1,936	1,592	0	0	1	7	8	43	0	1	396	440
Louisiana	127	59	22	46	1,013,326	*3,874	4,019	2	0	2	15	19	119	49	63	547	778
North	41	16	9	16	151,944	1,702	2,071	0	0	0	6	6	35	2	3	225	265
South	72	32	10	30	729,884	1,746	1,948	2	0	0	9	11	66	41	43	284	434
Offshore	14	11	3	0	131,498	426		0	0	2	0	2	18	6	17	38	79
Michigan	12	4	0	8	49,300	446	512	0	0	0	0	0	10	0	2	155	167
Mississippi	0	0	0	0	0	427	448	0	0	0	0	0	18	1	1	190	210
Montana	11	5	0	6	52,650	*495	412	1	0	0	5	6	12	0	1	182	195
Nebraska	19	4	0	15	110,200	*918	905	0	0	0	8	8	38	0	1	412	451
New Mexico	3	0	3	0	8,198	1,890	1,696	0	0	0	0	0	55	1	10	211	277
Northwest	3	0	3	0	8,198	*850	620	0	0	0	0	0	14	0	8	84	106
Southeast	0	0	0	0	0	1,040	1,076	0	0	0	0	0	41	1	2	127	171
North Dakota	3	3	0	0	20,682	*263	254	0	0	0	0	0	8	0	0	70	78
Ohio	0	0	0	0	0	1,073	1,224	0	0	0	0	0	2	0	5	6	13
Oklahoma	131	77	6	48	447,487	*8,056	8,411	2	2	2	15	21	130	24	41	672	867
Pennsylvania-New York	3	0	3	0	13,808	1,237	1,095	0	0	1	0	1	0	0	16	21	37
Texas	448	274	22	152	2,026,004	21,356	19,981	13	0	3	76	92	736	32	202	4,612	5,582
Southwest (1 & 4)	26	4	5	17	140,943	3,050	3,095	0	0	0	13	13	122	6	67	893	1,088
Gulf Coast (2 & 3)	44	16	5	23	320,179	2,615	2,506	0	0	0	0	0	64	16	78	692	850
East (5 & 6)	20	10	1	9	99,573	*1,133	984	1	0	1	8	10	17	3	8	403	431
N. Central (7-B & 9)	169	86	1	82	492,129	*7,654	7,433	5	0	0	43	48	331	0	12	1,847	2,190
West (7-C & 8)	159	136	2	21	865,023	*5,707	4,908	5	0	2	12	19	180	0	14	704	898
Panhandle (10)	30	22	8	0	108,157	*1,197	1,055	2	0	0	0	2	22	7	23	73	125
Utah	3	1	0	2	20,304	*141	94	0	0	0	1	1	1	0	5	70	76
West Virginia	14	3	7	4	36,577	684	640	0	0	0	0	0	0	0	15	12	27
Wyoming	30	10	0	20	87,087	*930	917	0	0	0	10	10	18	0	12	259	289
Miscellaneous	0	0	0	0	0	73	60	0	0	0	0	0	4	0	0	61	65
Total U. S.	**1,141**	572	82	487	4,865,408	†57,863	56,694	22	2	10	194	**228**	1,494	111	466	10,892	12,963
Total previous week	1,071	527	79	465	4,146,299			30	2	10	245	287	1,472	109	456	10,698	12,735
Total Dec. 31, 1955	640	324	65	251	2,526,830			15	0	7	106	128	1,601	215	353	10,133	12,302
Cumulative 1956	57,863	31,066	4,116	22,681	232,567,083												
Western Canada			(No report)			3,178											

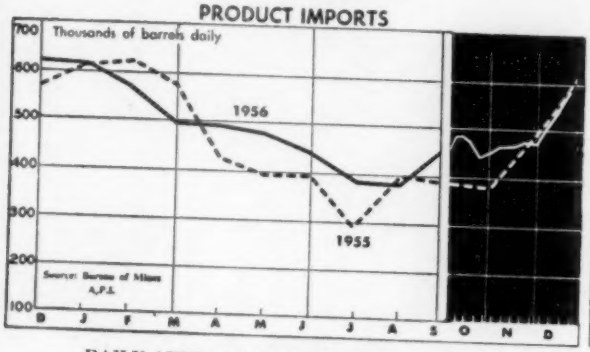
*1956 final. †Revised.

CURRENT STATISTICS — SUPPLY

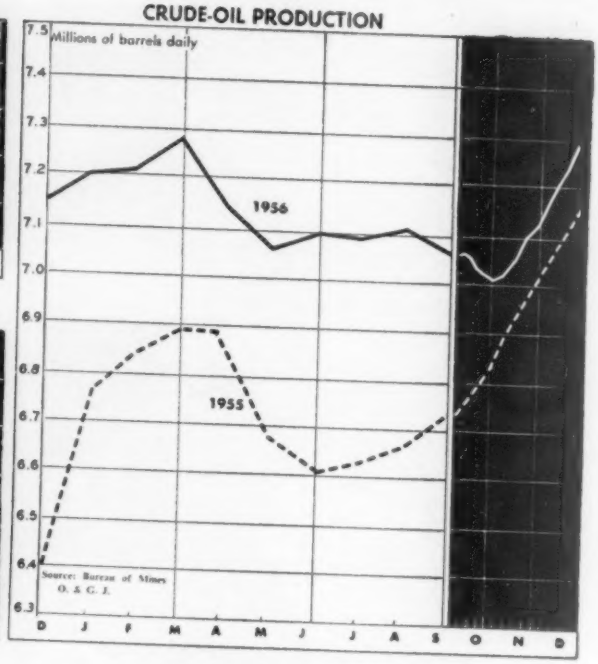
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



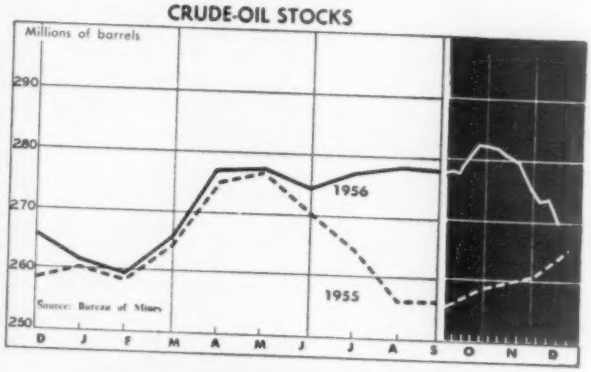
DAILY AVERAGE PRODUCTION FOR WEEK

	December 29, 1956			Dec. 15
	Crude oil	Lease condensate	Total	total
Alabama	11,500	.....	11,500	10,600
Arkansas	77,460	240	77,700	77,600
California	950,400	.....	950,400	952,600
Colorado	157,000	.....	157,000	158,100
Eastern	52,000	.....	52,000	50,000
Florida	1,300	.....	1,300	1,300
Illinois	241,600	.....	241,600	238,000
Indiana	33,200	.....	33,200	32,800
Kansas	†343,100	.....	†343,100	†341,000
Kentucky	48,700	.....	48,700	48,400
Louisiana	819,500	77,500	897,000	897,200
North	128,500	2,500	131,000	131,200
South	691,000	75,000	766,000	766,000
Michigan	28,200	.....	28,200	28,300
Mississippi	109,275	5,000	114,275	114,275
Montana	66,950	.....	66,950	66,200
Nebraska	39,100	.....	39,100	39,800
Nevada	150	.....	150	150
New Mexico	242,000	4,350	246,350	246,350
North Dakota	38,700	.....	38,700	33,500
Oklahoma	†616,400	.....	†616,400	†606,250
Texas	3,002,000	55,900	3,057,900	3,057,900
Dist. 1	55,500	575	56,075	56,075
Dist. 2	144,600	8,700	153,300	153,300
Dist. 3	430,500	26,000	456,500	456,500
Dist. 4	230,000	6,800	236,800	236,800
Dist. 5	39,500	550	40,050	40,050
Dist. 6	127,000	6,300	133,300	133,300
East Texas Field	207,900	.....	207,900	207,900
Dist. 7-B	159,000	60	159,060	159,060
Dist. 7-C	166,000	4,500	170,500	170,500
Dist. 8	1,128,000	1,500	1,129,500	1,129,500
Dist. 9	208,000	690	208,690	208,690
Dist. 10	106,000	225	106,225	106,225
Utah	8,150	.....	8,150	8,470
Wyoming	288,450	.....	288,450	285,000
Others	‡100	.....	‡100	‡100
Total U. S.	7,175,235	142,990	**7,318,225**	7,293,895
Change from prev. week, up			**24,330**	
Canada	†	†		†529,800

Total U. S. production, January 1-December 29 §2,599,308,100 bbl.
Same period last year (plus cond.) *2,470,853,418 bbl.

*Includes 41,265,900 bbl. of condensate. †Week ended previous Monday. ‡S. Dakota. §Revised.

CRUDE-OIL STOCKS



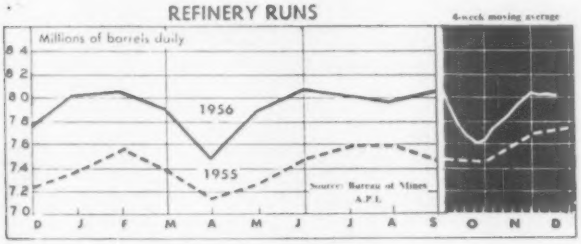
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

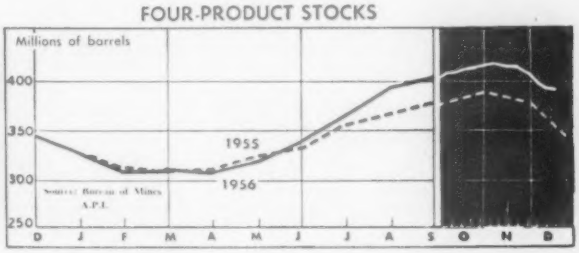
	12-22-56	12-15-56	12-24-55
Pennsylvania Grade	2,375	2,418	2,956
Other Appalachian	2,232	2,319	2,100
Illinois, Indiana, Michigan	11,223	11,332	9,219
Nebraska, North Dakota	2,344	2,451	1,978
Kansas	10,599	10,581	7,870
Oklahoma	22,986	23,110	22,126
Arkansas	2,815	2,919	2,407
Louisiana	18,987	19,078	16,176
North	4,306	4,139	2,563
South	14,681	14,939	13,613
Mississippi	2,649	2,780	2,814
New Mexico	8,454	8,402	7,634
Texas	120,730	122,777	123,903
East Texas proper	8,957	8,735	9,329
West Texas	57,414	58,867	58,486
Texas Gulf	23,803	23,739	24,527
Other Texas	30,556	31,436	31,561
Wyoming	16,417	16,303	15,231
Other Rocky Mountain	6,668	7,121	6,359
California	28,701	28,458	28,113
Foreign	†12,729	13,658	12,050
Total	269,909	273,707	260,936

*Bureau of Mines. †Includes 3,518,000 bbl. in California.

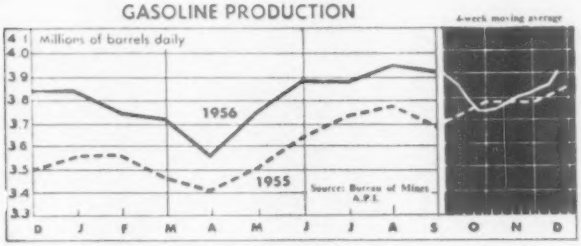
REFINERY RUNS



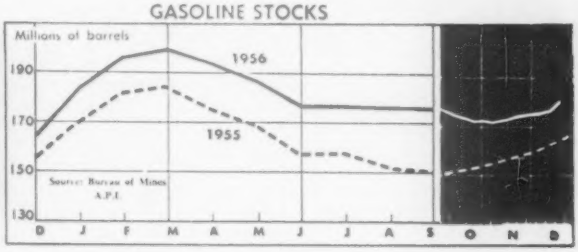
FOUR-PRODUCT STOCKS



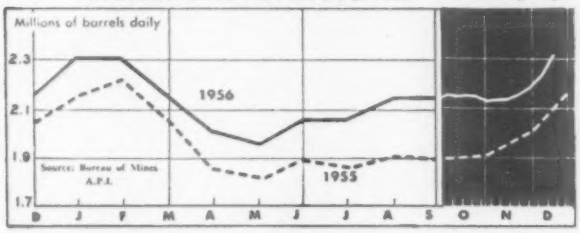
GASOLINE PRODUCTION



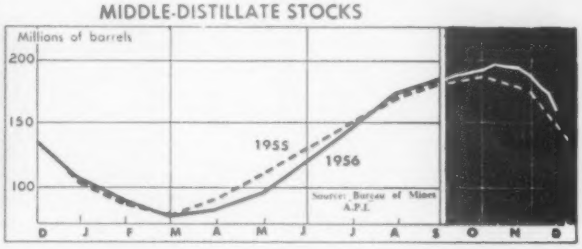
GASOLINE STOCKS



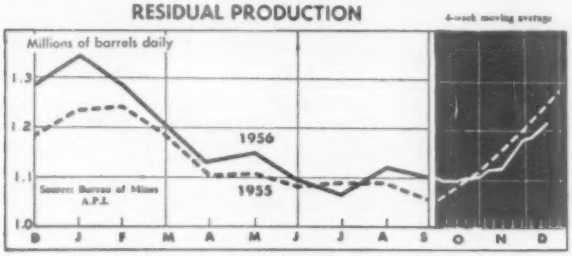
MIDDLE-DISTILLATE PRODUCTION



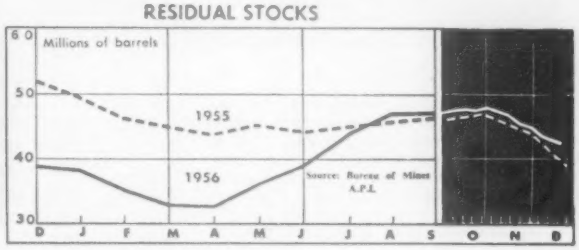
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, DECEMBER 21, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,214	518.9	47.1	342.4	241.0	39,734	12,634	52,124	11,385	1,102	428.0	27.6	267.4	222.9
Appalachian:														
District 1	101	39.1	6.0	24.3	8.6	4,712	594	3,143	368	112	46.1	5.5	21.1	8.2
District 2	116	58.1	8.0	24.7	16.0	2,936	651	1,084	258	91	50.7	3.8	18.1	12.5
Ind., Ill., Ky.	1,444	742.7	81.7	313.1	208.3	30,843	6,793	20,609	5,379	1,375	751.2	73.3	272.1	192.8
Minn., Wis., Dak.	90	46.1	6.6	19.9	7.4	7,224	1,490	7,464	129	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	702	413.3	16.7	201.6	47.3	16,234	1,610	13,272	1,466	693	406.2	17.8	162.9	34.9
Inland Texas	278	208.4	9.0	55.6	19.8	7,235	596	1,887	1,797	251	186.8	9.8	47.2	19.0
Texas Gulf Coast	1,949	904.6	127.4	530.4	250.6	26,363	3,031	12,226	6,096	1,940	907.8	137.3	481.2	255.1
La. Gulf Coast	681	363.4	53.3	190.7	80.6	11,642	2,822	5,517	1,631	688	357.8	54.8	165.3	48.1
N. La. and Ark.	103	43.9	11.3	20.6	7.3	4,582	1,010	2,047	271	97	36.7	6.4	24.9	6.7
Rocky Mountain:														
New Mexico	25	13.7	0.6	5.0	4.1	575	13	112	63	22	11.0	0.4	3.9	2.6
Other Rocky Mt.	262	137.2	2.9	63.0	32.7	5,565	426	2,954	895	256	122.8	4.3	62.0	42.3
West Coast	1,096	513.2	.....	200.8	341.4	22,898	359	12,541	12,839	1,065	482.7	.....	153.7	368.6
Dec. 21, 1956	8,061	4,002.6	370.6	1,992.1	1,265.1	180,543	32,029	134,980	42,577	7,692	3,787.8	341.0	1,679.8	1,213.7
Dec. 14, 1956	8,000	3,866.6	345.4	1,943.1	1,194.3	177,037	32,418	139,610	43,145	.....	.....	.....	.....	.....
Dec. 23, 1955	7,838	3,866.1	399.4	1,763.6	1,286.4	161,741	28,778	117,954	39,500	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	10.75-11.50
Premium (96 octane)	12.50-13.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California (rack):	
Regular (84 octane)	12.6-13.1
Premium (93 octane)	13.6-14.1
Premium (96 octane)	14.6-15.1
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.25-10.50
Diesel oil (58 d.i. and above)	9.875-10.125
Distillate No. 1	9.875-10.125
Distillate No. 2	9.25-9.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.75-10.25
Distillate No. 2	9.25-9.75
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
Distillate No. 2	9.25

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.30-2.50
Gulf Coast (cargoes):	
Bunker C fuel	$2.40-2.80
New York Harbor (barges):	
Bunker C fuel	$3.05
Caribbean (cargoes):	
Bunker C	$2.40
California (rack):	
Bunker C fuel, Los Angeles	$2.50

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.42	....	....	....	....
15-15.9	2.46	....	....	....	$1.93
16-16.9	2.49	....	....	....	1.97
17-17.9	2.53	....	....	....	2.01
18-18.9	2.57	....	....	....	2.05
19-19.9	2.60	....	....	....	2.09
20-20.9	2.64	$2.50	....	$2.37	2.13
21-21.9	2.68	2.52	....	2.39	2.17
22-22.9	2.72	2.54	....	2.41	2.21
23-23.9	2.76	2.56	....	2.43	2.25
24-24.9	2.80	2.58	$3.01	2.45	2.28
25-25.9	2.84	2.60	3.03	2.47	2.31
26-26.9	2.88	2.62	3.05	2.49	2.34
27-27.9	2.92	2.64	3.07	2.51	2.37
28-28.9	2.97	2.66	3.09	2.53	2.40
29-29.9	3.02	2.68	3.11	2.55	2.43
30-30.9	3.07	2.70	3.13	2.57	2.46
31-31.9	3.13	2.72	....	2.59	2.49
32-32.9	3.19	2.74	....	2.61	2.52
33-33.9	3.25	2.76	....	2.63	2.55
34-34.9	3.31	2.78	....	2.65	2.58
35-35.9	3.36	2.80	....	2.67	2.61
36-36.9	3.40	2.82	....	2.69	2.64
37-37.9	3.43	2.84	....	2.71	2.66
38-38.9	....	2.86	....	2.73	2.68
39-39.9	....	2.88	....	2.75	2.70
40 and up	....	2.90	....	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold Texas, North Louisiana, Arkansas. †Low-cold-test Gulf. ‡Sour.

Effective dates: California, November 19, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	3.04
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26.5°-26.9°, Amuay*	2.40
Quiriquire, 16.5°-16.9°, Caripito	2.40
Lagunillas heavy, flat, Amuay or Las Piedras*	2.33
Bachaquero, 16.5°-16.9°, Las Piedras*	2.18

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON
(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC+225%)	$9.26
Gulf-U.S.N.H., dirty (USMC +222.5%)	9.19
N.W.I.-U.S.N.H., dirty (USMC +205%)	8.24
N.W.I.-U.K., dirty (scale+325%) (138s. 2d.)	19.26
★Los Angeles-Japan, dirty (USMC +40%)	10.64

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Portrait by Fabian Bachrach

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Tulsa, Oklahoma

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FOR SALE at Arkansas City, Kansas: 2—4' x 53'9" Tunlsa Boiler type code welded 20 tray—24" spacing absorbers 400# WP. Lowered. Piping and fittings included. New 1944. Each $6500.00. Cities Service Oil—Patridge—Bartlesville.

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14 horizontal welded steel tanks, 10' dia. x 40' long, dished heads, thickness 3/8" throughout, 25,000 gal. each, used for aviation gasoline.

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Number of propane and butane tanks from 2,500 to 20,000 gal.

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7" O.D. 9187' 23# 8 Rd Thrd N-80 LT&C R-2 & 3

7" O.D. 6585' 23# 8 Rd Thrd J-55 ST&C R-2

7" O.D. 1550' 26# 10 V Thrd Grade D LT&C R-2

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SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

127' TYPE B OIL WELL Jackknife Derrick with five-sheave crown, 10' x 42' x 24' Split Type Sub-Structure, steel flooring. Price, $7,500. IVERSON SUPPLY COMPANY, Kermit, Texas. Phone 3491.

FOR SALE at Ponca City—2—used #12 Sweetland filter presses, 36 leaves covered with 200 Mesch monel screens, 60 additional leaves and some new repair parts—Cities Service Oil—Patridge—Bartlesville, Oklahoma.

U-15 RIG, 3 MOTORS, 131' Lee C. Moore Mast, 7 3/4 x 16 Gardner-Denver Pump, 7 1/4 x 10 Gardner-Denver pump, 8200' Drill Pipe, Steel Mud Pits, Hydraulic Floor Operated Schafer Blowout Preventor. Now operating in Harper County, Oklahoma. $5,000.00 cash. $5,000.00 a month to responsible people CEntral 2-6318, Oklahoma City.

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BESSEMER GAS COMPRESSORS—3 type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOUR 10 GROOVED Vee Belt pulleys grooved for C belts. 1—44 inch with Q.D. Hub for 3 3/4 shaft, $100.00. 1—11 inch with Q.D. Hub for 3 inch shaft $25.00. 1—9 inch $20.00 and 1—8 inch $15.00, both for 3 inch shaft. All new pulleys used less than 30 days. C. H. Barker, Box 91, Toronto, Kansas.

FOR SALE at our Seminole, Oklahoma Lacy gasolene plant 13—10' x 40' used horizontal gasolene storage tanks, 5/16" shell, 3/8" dished heads, end manhead, lapped and riveted 6" CC rivets. Seams welded inside and out, relief valve—each $1,000.00. Used only for raw gasoline. New 1929. Cities Service Oil Company—Patridge—Bartlesville, Oklahoma.

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FORMER LACY REFINERY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
6—Brown fintube exchangers, 300# 140 sq. ft. 4-6 chrome.
1—5' x 96' tower, 40 tray, 135# WP.
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
3—Welded tanks, 10' x 40', 5' x 20'.
2—8 1/2' x 25' Tanks 50#
1—Ethyl lead plant.
2—Convection furnaces, 20 MIL BTU/hr.
12—Welded storage tanks, 5,000, 2,000, 1,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
4—Steel Bldgs., 20 x 20, 20 x 40.
1—BS&B O&G separator, 10.7 mcf/day. Large Selection of Series 15, 30 Steel Valves, 1" to 8"
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm —3,100' hd.
5 Pacific SVTB, 612 gpm—600' hd, 324 gpm —480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' Hd.

IN STOCK

HEAT EXCHANGERS

3—Kellogg Adm. Fltg. Hd. 2200, 1800 Sq. Ft., 315#
4—Kellogg Steel Fltg. Hed. 800, 650, 500 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp.
2 Clark RA-5 500 hp.
3 Penn Comps 100 CFM 500 lbs. 385 CFM 160 lbs.

MISCELLANEOUS

6—Bird Centrifugals 32 x 50, 24 x 38 18 x 29.
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5.
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
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30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
9—3' x 10' 410 SS Sheets.
Tremendous selection stainless steel and steel valves 1 1/2"-6".
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Goulds 16" pump, 10,500 gpm, 135' hd.

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- 2,500,000 bbl. Storage Tanks from 500 to 100,000 bbls.
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- Polymerization Plant
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FOR SALE—1—FAC-19 SS Pur-O-Cell filter, serial #FC-35637, new 1953—$850.00. 1—FAC-10 steel—ditto—serial #FC-33717, new 1951—$350.00. 3—Model CF Sealless magnetic drive Chempumps, new 1954, each $250.00. Used stainless steel, 2" pipe, valves and fittings—50% new. 1 each type CPS 2 and 3 Lapp Pulsafeeder Chemproportionating pumps—new 1954—$500.00 and $750.00. Cities Service Oil—Patridge—Bartlesville.

CASING FOR SALE: 176' of 7⅝ OD, 26.40#, J-55, 8rd, ST&C, SS. 506' of 8⅝" OD, 28#, H-40, 8rd, ST&C, SS. 267' of 8⅝" OD, 32#, J-55, 8rd, ST&C, SS. 434' of 8⅝" OD, 36#, J-55, 8rd, ST&C, SS. 1075' of 8⅝" OD, 36# J-55, 8rd, LTC, SS. 706' of 9⅝" OD, 32.30#, H-40, 8rd, ST&C, SS. May be inspected Canyon Trucking Corp.'s yard, Midland, Texas. PIPE Inc. P. O. Box 4137, Corpus Christi, Texas. Phone TU 4-4029.

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Graduate Engineers with experience in oil producing operations including pressure maintenance, secondary recovery, primary depletion. Initial assignment in New York Office in reservoir engineering and research section concerned with oil field development studies. Salary and position commensurate with qualifications.

Write giving full particulars regarding personal history and work experience.

Recruiting Supervisor, Box 199

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GRADUATE CHEMIST—Age 30 - 45 Years—capable of supervising Control Laboratory and Blending Operations of plant making gasoline and petro-chemicals. Location: Southern City of 150,000. Send complete record of education, experience and minimum salary expected. Write Box J-864, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST. Desire to employ competent and experienced geologist with executive ability to head and direct large exploration program of independent oil and gas producer. Requirements: minimum of 10 years experience in oil exploration with a portion of it on the Gulf Coast. Age 31-45. All replies will be kept confidential. Box No. 3053 Dallas, Texas.

SALES REPRESENTATIVE

for pipeline construction equipment for New York sales area. Salary commensurate with experience and ability. Write full details of qualifications and experience to

BOX J-866,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

PROCESS ENGINEER with thorough technical training and minimum background of eight years refining and hydrocarbon processing experience with special emphasis on catalytic reforming and petrochemicals. Send complete record of education, experience, and minimum salary expected. Write Box J-867, The Oil and Gas Journal, Tulsa, Oklahoma.

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Here is your opportunity to join RCA in a responsible permanent assignment!

You will supervise the installation of microwave equipment at field locations, as RCA's representative for coordination of the activities of local contractors. In addition, you will be in charge of final tune up and test of equipment.

You should have 6 years' experience in communications, with 2 years' in frequencies above 1,000 megacycles. Some knowledge of construction preferred.

You'll enjoy: good starting salary, paid vacations, retirement plan, liberal company-paid benefits for you and your family, relocation assistance.

Please send resume of experience and education to: Mr. E. W. Taylor, Employment Coordinator, Dept. E-3A, Radio Corporation of America, Bldg. 5-1, Camden 2, New Jersey.

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(AGE 30 - 38)

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BOX 480
A-21
New York 19, New York

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TWO SALES ENGINEERS to be located in South Louisiana. Must have either oil field production or sales experience. Salary open, send resume of education and experience to Box J-857, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES MANAGER for large independent Mid-West refiner. Must be under 55 years of age and experienced in asphalt sales. Very good salary and opportunity for right man. Apply Box J-861, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF CHEMIST with at least six years refinery experience. Must be aggressive and have some asphalt experience, for an 18,500 BPD Independent Texas Refinery. Also Chemist with at least three years experience to handle gasoline research as well as other light oil products. Apply Box J-776, The Oil and Gas Journal, Tulsa Oklahoma.

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HELP WANTED

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GAS ENGINEER—Leading independent oil company has opening for graduate engineer under 32 with general knowledge of construction, operation, and maintenance of gasoline plants, gathering systems, compressor stations, gas pipe lines and related facilities. Also knowledge of process engineering. Dallas, Texas, or Shreveport, Louisiana, location. Write full particulars as to personal background, education, experience, and salary requirements to P. O. Box 3053, Dallas, Texas, and enclose small photo.

GAS ENGINEER—Graduate engineer with four years or more experience and background in gas transmission engineering and operations—design of compressor station, pipeline, and related facilities—for position of staff engineer, chief engineer's office of large natural gas transmission company. Location area—Pacific northwest states. A considerable opportunity for development exists in this position. Salary commensurate with qualifications. Replies will be held confidential. Write Box J-843, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

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PRODUCTION ENGINEER: Desires responsible position with aggressive independent. 11 years experience engineering and production with major company West Texas, 2 years wildcatting Rocky Mountains. Married, 36 yrs. of age, B.S. in Petroleum Engineering. Box J-856, The Oil and Gas Journal, Tulsa, Oklahoma.

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PETROLEUM ENGINEER 8 years experience major oil company drilling, production and water flood, desires responsible position with independent or smaller oil company. Box J-869, The Oil and Gas Journal, Tulsa, Oklahoma.

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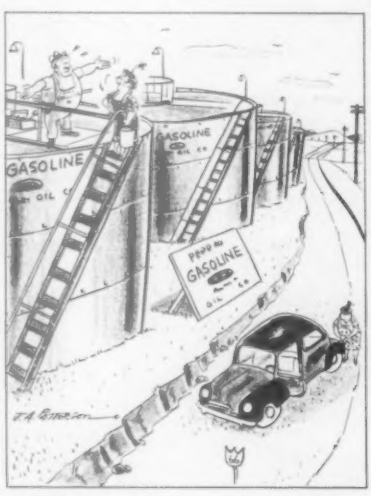

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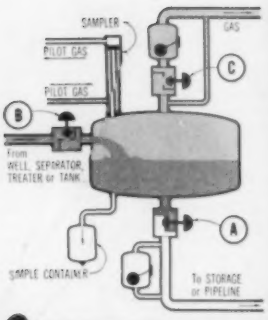

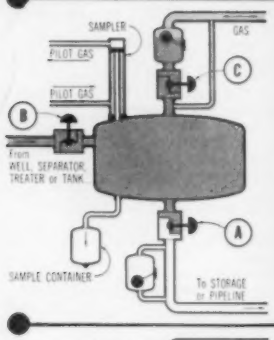

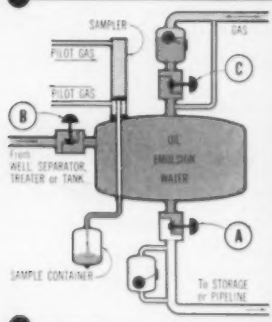

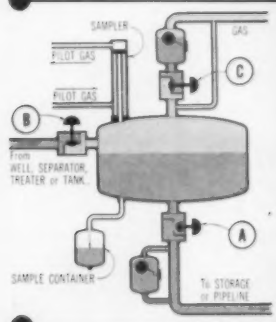

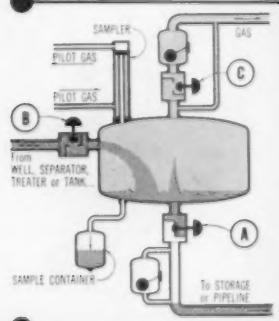

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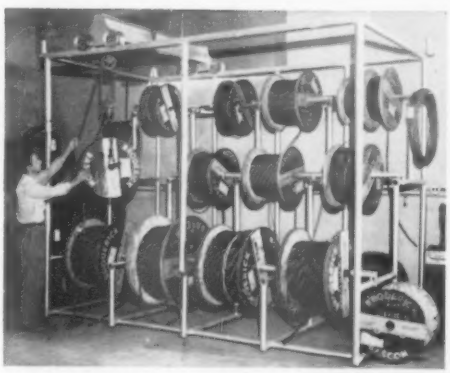

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